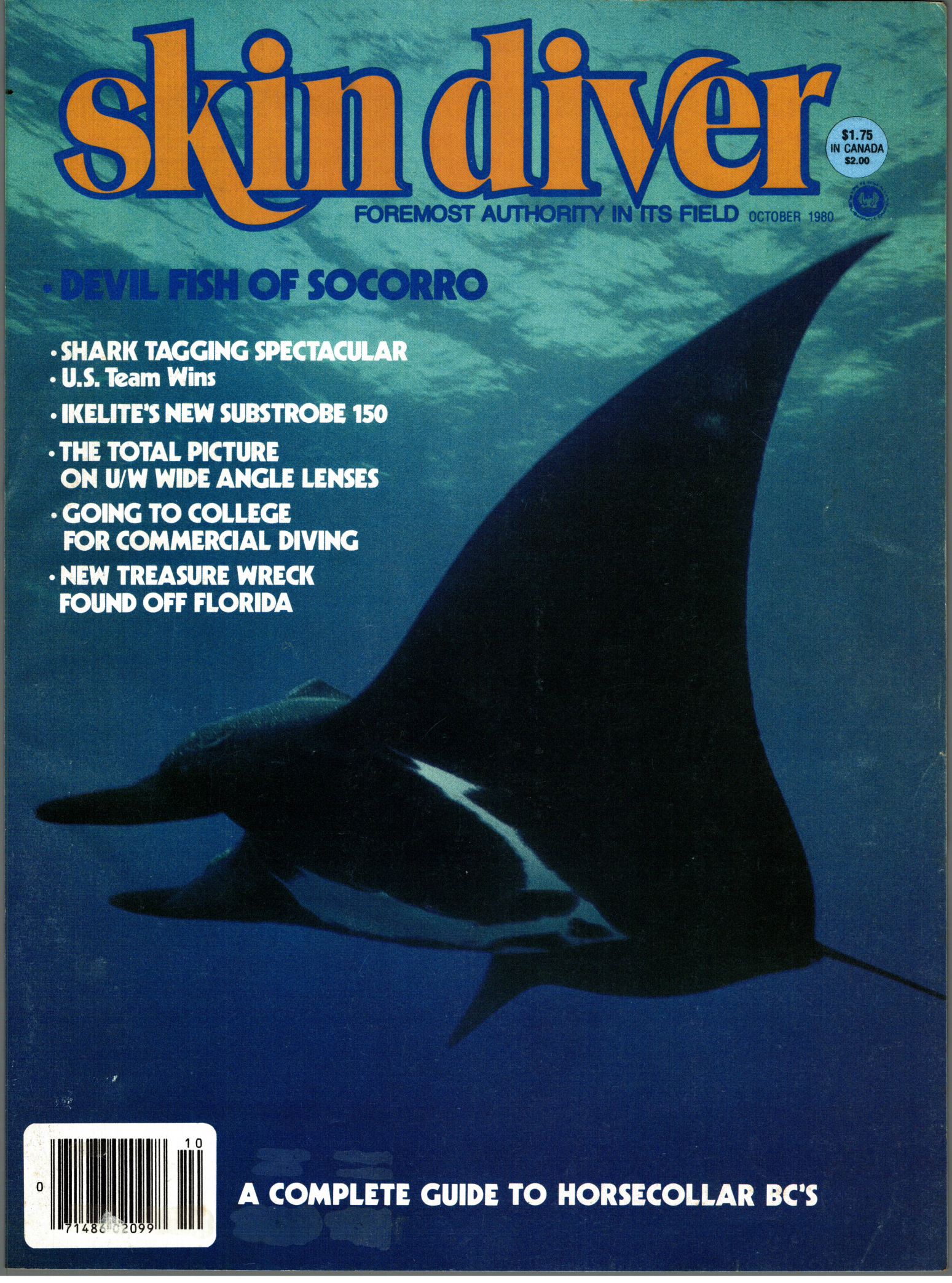
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Volume Twenty-Nine Number Ten

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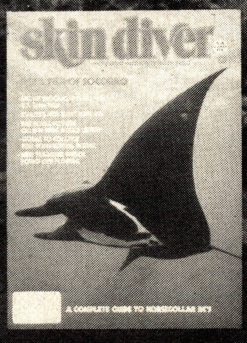
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COVER
Howard Hall visited the Revillagigedos Archipelago, four islands several hundred miles south of the Baja Peninsula, and found an underwater paradise replete with giant manta rays. See page 22.

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SDM Editorial

BY THE PUBLISHER



BC's — A REAL PICK UP!

The dive industry has come a remarkably long way in the development of personal flotation devices. It is hard to believe that it was only twelve years ago that sport divers were struggling with archaic CO_2 vests dating back to World War II designs. Those were terrible times, when pot metal inflator mechanisms would corrode and jam, when firing pins would rust and snap off, when entire inflator mechanisms would rip clean out of the vests during an open water emergency!

Thankfully, these problems are far behind us now and a debt of gratitude is owed to people like Dr. Glen Egstrom and John McAniff for doing the research necessary to expose the problem. The dive equipment manufacturers were quick in responding to the situation, and it wasn't long before new CO_2 inflator designs, with non-corrosive space-age plastics and stainless steel parts, were put into mass production.

But following quickly on the heels of CO_2 vest improvements, there came a revolutionary concept in flotation devices — the buoyancy compensator. Instead of serving as just a one-shot emergency device for surface inflation, here was a piece of gear that could be used as a tool on every dive. It made diving less strenuous at depth, and constant use helped to ensure reliability should an emergency arise. The advantages were obvious.

SDM published the first test reports on foreign made buoyancy compensators in late '68, '70, and '71. The new BC designs were such a radical departure from what was being used at the time that they stirred a great controversy. Instructors debated the possible dangers and advantages involved. Training procedures would have to be modified so that new students could be safely instructed in their use. The rest is history.

Buoyancy compensators caught on like crazy. Within five short years, every major dive equipment manufacturer in the U.S. was producing and selling at least one or more versions of the buoyancy compensator design. This year there are no less than 50 different BC models available on the American market. And the evolution continued with a whole new wave of buoyancy compensating backpacks.

From a technological point of view, the CO_2 vest is just about as antique as the Model-T Ford. Yet in spite of the advantages of the BC, we still see many divers wearing obsolete flotation gear.

We can perhaps understand why an old time diver might be reluctant to discard his favorite vest. In his eyes, this trusty, well lubricated CO_2 vest has worked just fine for several years — so why change? Why spend a lot of extra money on some new expensive gadget?

The trouble with old time divers is that they sometimes tend to forget one of the basic rules of diving — "Safety Through Education." And education is a lifelong continuing proposition; keeping yourself updated on new equipment designs is part of that process. Just because an old pro has been fortunate to survive five or ten years of diving doesn't mean he's invincible. Diving accident research has proven that old time divers can drown just as easily as novices — if they make a mistake. Ignoring new dive gear designs is the old timer's first mistake.

But the most disheartening sight is to see a new diver arriving on the beach or dive boat wearing a CO_2 vest. It means that he's been misguided by poor equipment advice from his scuba instructor, a friend, or a dive shop clerk. Had he or she been fully informed on the advantages of the buoyancy compensator, it is doubtful that the novice diver would have purchased anything less than the most modern design available.

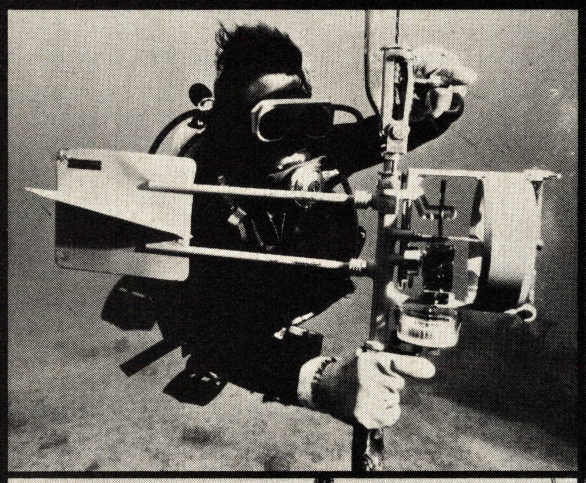
Why some instructors continue to ignore the obvious advantages of the BC is a mystery. Are divers so set in their ways — so obstinate — that they would purposely stand in the way of progress? Some claim to do it in the name of economy, cost savings, anti-inflation, or whatever you care to call it. They have convinced themselves that most scuba students cannot afford expensive buoyancy compensators. They rationalize to themselves that a student is better off with a CO_2 vest than with no buoyancy compensator at all.

In reality, such well intentioned instructors end up doing a disservice to their students. Instead of emphasizing the safety value of a BC, they end up comparing prices. Granted, a good buoyancy compensator is far more expensive, but then a good scuba tank and regulator are equally expensive. Both are vital to safe diving technique.

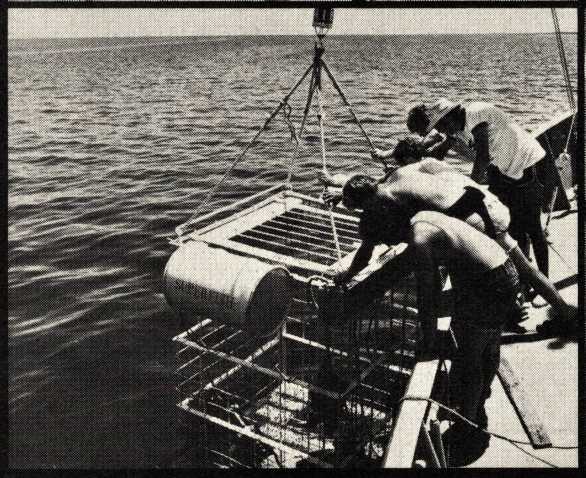
It is this magazine's opinion that no diver should settle for less than the best when it comes to a piece of dive gear which may someday save his life. The buoyancy compensator is truly a significant advancement in dive equipment design, and it should be regarded as a basic requirement for serious minded sport divers. In fact, many dive clubs list BC's as mandatory gear for official club dives.

Diving today is expensive — there's no question about that. However, the rapidly rising costs of basic dive gear is not entirely due to inflation or the manufacturers' desire to get rich overnight. A lot of money has been invested in the development of safer, more reliable dive equipment designs. These improvements often mean added production and assembly costs. If we want better gear, we are going to have to pay the price. Isn't your life worth it?

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Some underwater photography courses begin and end in a swimming pool. Our underwater photo courses begin in a modern photographic laboratory and conclude with practical ocean experience aboard one of our diving vessels in the Caribbean.

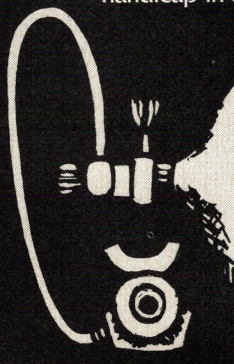
We could teach recompression chamber operation with just one chamber. We don't. We have three.

Oceanography is usually taught from a textbook. We use a textbook, too; but our students also gain valuable experience aboard our two ocean-going research vessels.

The shark cage above is self-contained, buoyancy-controlled, and surface-communicating. You might have read about it elsewhere. We could have assigned the design and construction to our faculty. We didn't. Two of our students conceived, constructed, and tested the cage as a part of their regular academic program.

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McKENNEY BAHAMAS FILM AT DEMA

Jack McKenney, adventure editor of SKIN DIVER and president of his own film production company, is leading a team into the Bahamas to produce a half hour film for the Bahamas Ministry of Tourism.



His wife, Sari, as production assistant, his son John, as camera assistant, and co-producer Bob Abrams are currently on location for six weeks, headquartering out of eight islands and filming at 25 or more dive spots. Joining the team for much of the shooting will be George Hartwell, coordinator of Sports & Aviation for the Ministry of Tourism.

The film crew will headquarter out of Nassau, Crooked Island, Stella Maris, San Salvador, Harbour Island and North Eleuthera, Andros, Freeport and West End. Excursions will be made to Little Bahama Bank to film wild dolphins, to blue holes on Grand Bahama Island, and to many of the beautiful coral reefs and wrecks throughout the islands.

The film will be premiered at the DEMA show to be held on January 17-20, at the Las Vegas Hilton and will kick off Jack's new lecture series for 1981. His *Dive to Adventure* series, now entering its fourth year, has proven extremely popular. For information on scheduling the new Bahamas film, contact Jack at 1842 Micheltorena St., Los Angeles, CA 90026.

PADI SWEEPSTAKES

The PADI "Turn A Friend Onto Diving" Sweepstakes, the industry's first nationally coordinated student recruitment campaign, recently concluded. Thousands of entry forms were received, most of which represented new customers and/or students.

Over 270 prizes were awarded in the drawings held on July 15 at PADI Headquarters. Among these were the grand prize of a one week dive vacation to Cozumel won by Mary Ann Pankrate (entering through Treasure Cove Scuba of Niles, OH); and a second place prize of a $250 gift certificate won by Chris Moody (entering through Dynamo, Inc. of College Park, MD). In addition, hundreds of prizes were awarded at the local level. For anyone who did not get involved this year, look for the PADI Sweepstakes campaign again in the spring at your local PADI Training Facility. For information and a list of PADI Training Facilities in your area contact: PADI, 2064 N. Bush St., Santa Ana, CA 92706.

JON HARDY JOINS SSI

Bob Clark, chief executive officer of Scuba Schools International (SSI), has announced that Jon Hardy has joined SSI. Jon will develop new materials and programs, conduct courses and seminars, and expand SSI store membership, particularly in the West and Pacific. Jon will operate from his office in Avalon on Santa Catalina Island off the coast of Southern California, P.O. Box 782, Avalon, CA 90704.

FARALLON/OCEANIC PROMOTES RICE

Farallon/Oceanic announced the appointment of Glenn J. Rice as general manager. Mr. Rice joins Farallon/Oceanic after 16 years as department manager with Physics International Company in their engineering operations division. Mr. Rice brings to Farallon/Oceanic his complex technical support, varied engineering knowledge and organizational experience.

NC TREASURE HUNT

June 21 was the day of Wilmington, North Carolina's first treasure hunt. Held three miles off Wrightsville Beach, NC, the hunt was part of an effort by Undersea Sales and Engineering and Cape Fear Divers Club to stimulate diving in the area. Undersea Sales and Engineering provided over $1,000 in prizes — ranging from T-shirts to a jacket BC. Sixty of the 75 tokens were found by the end of the dive. The fluorescent hued, triangularly-shaped pieces of treasure were hidden in and around a liberty ship, part of an artificial reef. Refreshments for the divers were donated by the Patio, a local establishment. The dive was so well received that 1981 will see another one sponsored by Undersea Sales and Engineering.

JAMAICAN DIVE CODE

A code to regulate scuba diving in Jamaica has been prepared by the government and tourism interests. The goal is to ensure protection of people using dive equipment and facilities. The code outlines techniques and procedures for safety in diving, boat handling and hyperbaric work.

The creation of the code was spurred by increasing interest in Jamaica's underwater world by dive groups. Due to the peculiar nature of Jamaica's topography, deep diving is only a few hundred yards from shore.

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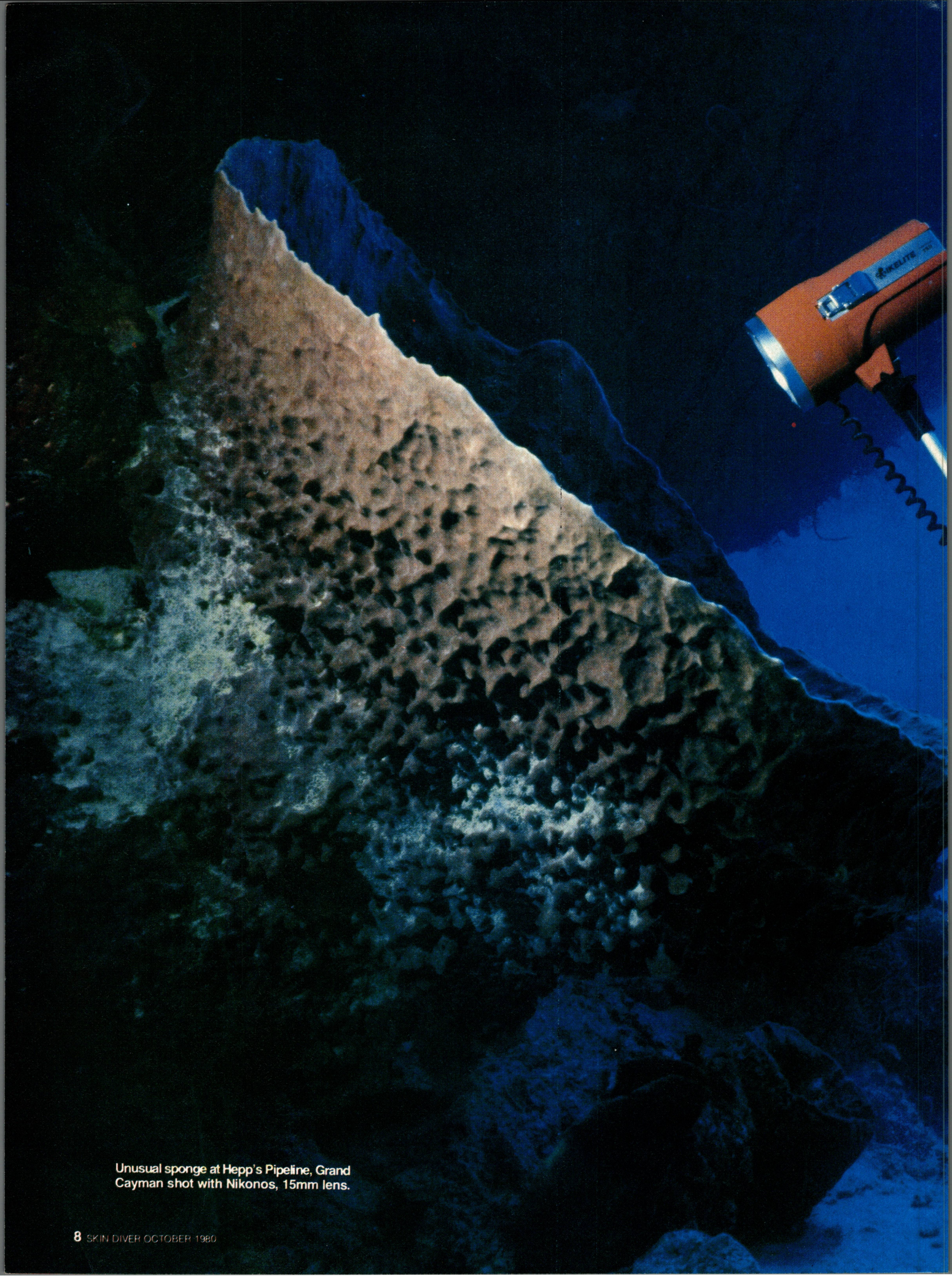
Having trouble believing it when it looks so similar to the competition? We dare you to put a Fara-Fin X on one foot and ANY competitor's on the other, and swim the length of a pool — your legs won't lie.

The new Fara-Fin X — at discriminating dive stores everywhere.



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Unusual sponge at Hepp's Pipeline, Grand Cayman shot with Nikonos, 15mm lens.

Widen Your Angle

wide-angle lenses and adapters give you a sharper, total scene

Text and Photography
by Jim and Cathy Church



The purpose of this article is to give you a closer look at three wide-angle lenses, and two wide-angle lens adapters, designed for use with the Nikonos camera.

U/W NIKKOR 15mm LENS

The Nikon 15mm lens is truly the Rolls Royce of wide-angle lenses for the Nikonos, and it can be used with any model of this camera body. The aperture range is from f2.8 to f22, the focus range from 0.3 meters (about one foot) to infinity, and the diagonal picture angle, 94 degrees. The lens shade consists of two visors, at the top and bottom, which extend three-fourths inch beyond the dome port for protection against accidental impacts.

Because the optical-glass dome port is corrected for U/W use, the lens doesn't produce sharp images in air. Underwater, however, it produces sharp, distortion-free images from corner to corner. In our opinion, the Nikonos 15mm lens is optically better than an equivalent lens on a housed camera behind a plastic dome port.

The large control knobs for aperture and focus are easy to operate. With the camera held in your right hand, the focus control knob is on the left side of the metal lens body. The aperture control knob is also at the left, a couple of inches below the focus control knob. The scales for aperture, focus and depth of field are beneath a curved glass plate on the right side of the lens body. Both scales must be aligned with a small black dot; but because this dot is difficult to see in dim light, we align the scales with the shiny screw head that is located close to the dot.

The 15mm lens is a complicated piece of equipment. If damaged or flooded, it will be difficult and expensive to repair. It also takes practice to master a lens this wide; you must learn to get closer to your subjects than you are accustomed to with narrower-angle lenses, and must learn to work with wide-angle perspective.

The metal lens caps of some early 15mm lenses are difficult to use: If you put them on in air, they are often impossible to remove underwater because of sea pressure. And if put on underwater, they are often impossible to remove in air. Later models have a small vent hole in the cap to equalize pressures. If you have an old cap, drill a small hole in its side.

The optical viewfinder shows extremely large, bright images and is masked to show about 90 percent of the true picture area. This helps ensure that subjects near the edge of the viewing

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THE 5 MILLIMETER GENIUS THAT GOES IN WATER, NOW GOES ON SALE.

When we first introduced the Xernus solar alarm chronograph to America, the response was overwhelming. Understandably so.

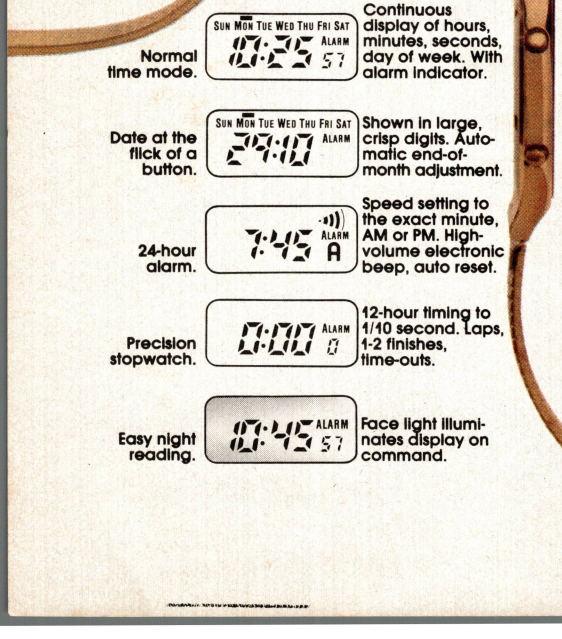
Where else could people have turned to find an electronic quartz timepiece with comparable talent and construction—for only $89?

Very possibly nowhere.

And now, eight months later, The Sharper Image does it again. By offering the talents of this thin watch/stopwatch at a sale price of only $79. (And with a generous 5 microns of gold, for only $99.)

Either way, you save $10. Even more when you consider the whopping sum stores will be asking—should they ever get their hands on this remarkable timekeeper.

Fortunately, you can get your hands on it a lot sooner, with a toll free phone call.



The world's slimmest solar alarm chronograph.

How trim is this brainy piece of jewelry—that gives you the time with ±15 seconds a month accuracy, the day and date, an alarm, a stopwatch and a solar-assisted battery—squeezed into a wafer?

Precisely 4.95 millimeters from the top of its mineral glass crystal to the back of its solid stainless steel case. (Xernus functions are further described in the face diagrams, below.)

Before you pick up your phone, we invite you to compare the thinness of Xernus to the world's remaining crop of solar alarm chronographs.

Seiko, an undisputed leader, sells a comparably talented timepiece for $250; it measures 10.5 millimeters from top to bottom.

In the Under-$150-League, competition for slimness in alarm chronographs is even more dismal. Texas Instruments' is 12.0 millimeters thick; the Advance, 9.5 millimeters. And these are some of the thinnest.

Craftsmanship that's rare at even $150 more.

Both case and bracelet of Xernus are machined from solid stainless steel, not plated base metal or "silvertone" (a material that pits and peels, often after only a few weeks of light use).

Once again, the face isn't scratch-prone plastic, but rock-hard tempered mineral glass.

And the manufacturer of Xernus is one of the few who dare to even mention water-resistance. Better yet, they guarantee your Xernus against water damage to 60 feet below the surface. (They're conservative; it has proven to survive in 90.)

Other Xernus distinctions?

Mirrored face plating; a highly difficult technique that's just now beginning to frame the displays on only the most costly digitals. A tightly meshed, smoothly polished bracelet that doesn't pull at skin or hair. Recessed function buttons that stay out of your way.

This unusual timekeeper is available to you in two different models: all Stainless or Gold (with a rich 5 microns worth over stainless). Incidentally, that's real gold, not "goldtone".

Xernus comes with full instructions, service-by-mail, if needed, a one-year manufacturer's guarantee against defects, and its battery in place. (Sensitive to sunlight or even dim roomlight, Xernus solar cells will keep this micro-thin battery working for up to 2 years. Replacements are available at most jewelers.)

And best of all, you have the chance to see a Xernus perform right on your wrist—before making your final commitment.

Keep it for two weeks. And if for any reason you decide not to be a Xernus owner, simply send it back (in new condition, please). And The Sharper Image will return your entire investment without question. Including the delivery charge.

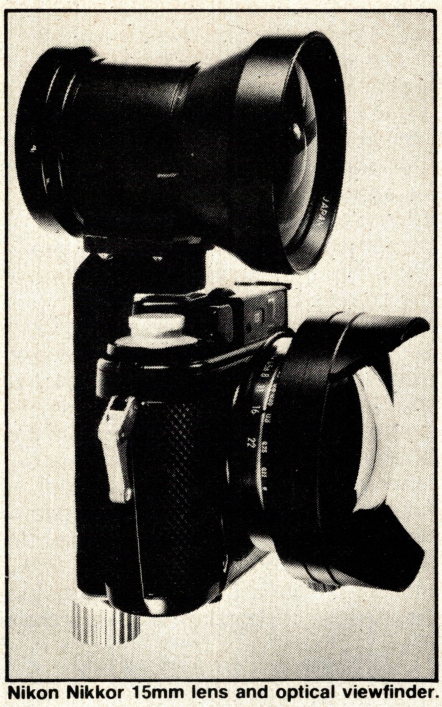
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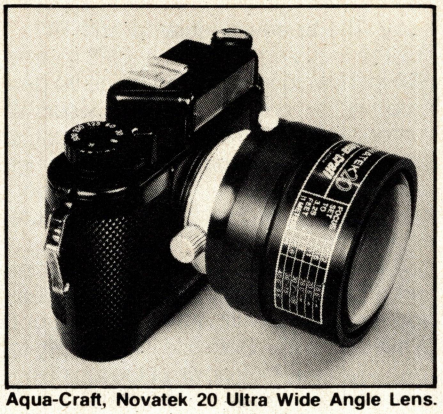
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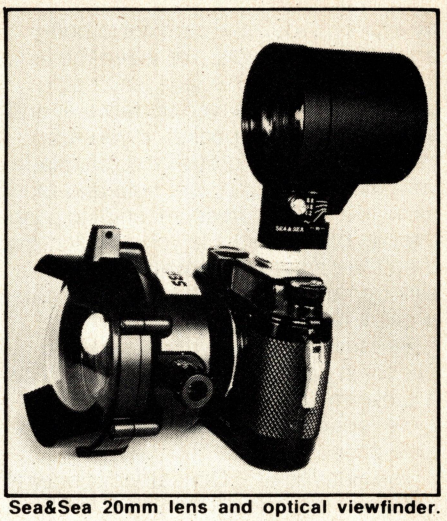
Nikon Nikkor 15mm lens and optical viewfinder.



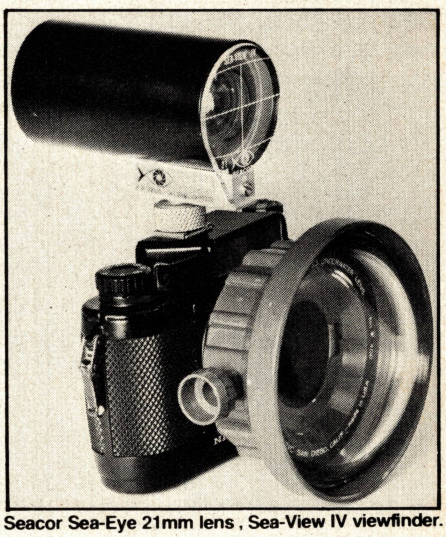
Aqua-Craft, Novatek 20 Ultra Wide Angle Lens.



Farallon/Oceanic Subawider II wide-angle adaptor.



Sea&Sea 20mm lens and optical viewfinder.



Seacor Sea-Eye 21mm lens , Sea-View IV viewfinder.

area won't be cut out of the picture area. The parallax correction is for about five feet.

The viewfinder is attached to the camera body at two points: A shoe slips into the accessory mount on top of the camera body, and a clamp fits under the bottom of the body. The clamp can be opened to allow about one-quarter inch of clearance, thus it will fit over most baseplates used with Nikonos cameras. If you use a baseplate, be sure to check the tension on the viewfinder clamp frequently. We've seen the clamp work loose, and the viewfinder fall off the camera. And after use, wash and lubricate the threads of the clamp adjustment knob — it can freeze with corrosion.

NOVATEK™ 20

The Novatek™ 20 Ultra Wide Angle Lens is available from Aqua-Craft (7992 Miramar Rd., San Diego, CA 92126). It is a slip-over, wide-angle adapter that fits over the standard Nikonos 35mm lens. The 95 degree picture angle is influenced by barrel distortion in the extreme corners of the subject area. Image sizes in the central picture area usually appear (in our opinion) to be about the same size as those taken with a 21mm lens.

A nylon setscrew presses against the side of the Nikonos lens mount and provides the necessary friction to keep the Novatek 20 in place. This setscrew needs only a finger-tight adjustment (made before placing the Novatek 20 over the Nikonos lens). To install the Novatek 20, begin by pressing the setscrew against the side of the Nikonos lens mount, and then gently pressing the other side in place. Once the setscrew is adjusted properly, the Novatek 20 is easy to attach or detach — just use the setscrew as a pivot point. Once installed, the Novatek 20 fits snugly in place.

The front edge of the cylindrical body protects the edge of the plastic dome port from accidental impacts, but the front of the dome port extends about one-quarter inch past this edge. Thus, take care not to bump the dome against hard objects.

The label attached to the Novatek 20 has two depth of field tables for apertures ranging from f4 to f22. One table assumes that you preset the Nikonos lens for 3 feet, and the other for 3.5 feet. These tables imply that you preset for one of these distances and do not change the focus setting during use. Using the three foot table, for example, the indicated depth of field is from 23.5 inches to infinity at f11, and 15.5 inches to infinity at f22.

Exposure is controlled by the Nikonos 35mm control knob. To see the aperture scale, tilt the camera back and look through the dome port. If the f stops are difficult to read in dim light, set the aperture for f22 and count click stops as you move to the lower-numbered stops. If your lens doesn't have click stops, the Novatek 20 is easily removed so you can see the scale directly.

If you use the Novatek 20 with a viewfinder designed for the 35mm or 28mm lens, you will have to learn how to judge the wide-angle subject area. Because good composition requires a wide-angle viewfinder, we suggest that you purchase one from another company because Aqua-Craft doesn't supply them.

A fisheye wide-angle attachment for the Nikonos 35mm lens, and several other U/W photographic products, are also available from Aqua-Craft.

SEA-EYE 21mm LENS

The Sea-Eye 21mm lens is assembled and distributed by Seacor Inc. (P.O. Box 22126, San Diego, CA 92122). It has a molded, plastic body available in black or blue, and a plastic dome port. The diagonal picture angle is 92 degrees, the aperture range is from f3.3 to f16, and the focus range is from 2.5 feet to infinity.

The aperture and focus control knobs are located at the left and right sides of the lens body. The Sea-Eye lens can be attached to any Nikonos in two positions (right side up, or upside down), so that either control knob can be at the left or right, depending on your preference. The aperture and focus scales are easy to read — simply look through the dome port. The focus scale, however, doesn't show depth of field. To use a filter, simply unscrew the rear lens element mount (it turns to the left with finger pressure) and drop a disc of filter gel inside. Replace the rear element and the filter is now mounted inside the lens system.

Because the dome port isn't protected

by a lens shade, take care not to bump it against hard objects. We leave the lens cap on whenever the lens isn't being used. It can be removed underwater and stored in your BC pocket. If you have trouble pulling the pressfit cap off, place your mouth over the vent hole and blow air inside. The air pressure tends to push the cap off. And should you accidentally drop the camera underwater, it tends to sink dome up. A small point, but it can prevent damage.

Because the Sea-Eye is assembled by Seacor in California, repairs shouldn't be a problem. We've heard that they complete repair work quickly and at reasonable prices.

The Sea-View IV Optical Viewfinder is designed for use with the Sea-Eye 21mm lens. It slips into the accessory mount on the camera body, and a knurled locking nut is screwed down with finger pressure to hold it in place. The viewfinder is parallax corrected for about three apparent feet, and is easy to use — just press the rear of the viewfinder against your mask. Because the rear of the viewfinder extends a few inches back behind the camera body, the camera shouldn't bump your purge valve or regulator. Remove the viewfinder when topside; it supports part of the weight of the camera system when the camera is lying on its back, and this can stress the small screws which hold the accessory mount to the camera body.

The Super-Eye, a fisheye lens housing for using a Nikon, Accura or Spiratone 8mm fisheye lens with the Nikonos, as well as brackets and arms for using twin strobes, are also available from Seacor.

SEA & SEA 20mm LENS

The Sea & Sea 20mm lens was previously distributed in the U.S. by Leach Photo Systems, and may be distributed by another company in the future. We have examined one of these lenses, but haven't had the opportunity to use it underwater.

The Sea & Sea 20mm lens has a plastic body, a plexiglass dome port, and it can be attached to any Nikonos camera body. The aperture range is from f4 to f16, the focusing range from 0.25 meters (9.8 inches) to infinity, and it has 84 degree full frame coverage. Twin visors at the top and bottom extend past the dome port for protection from impacts. A mount is molded on the body, near the top visor, for an unspecified (at this writing) future accessory.

The aperture and focus scales are located on the sides of the control knobs, and are aligned with marks on the sides of the lens body. Both scales are easy to read — simply look down at the top of the lens and both scales are visible. The focus scale shows distance only, and not depth of field. Because the controls and scales are well-placed, the lens should be easy to operate underwater.

The plastic-bodied optical viewfinder attaches to the accessory mount on top of the camera body, and a locking ring, tightened with finger pressure, holds it in place. The viewfinder is adjustable for parallax. You adjust the tilt by hand to match the distance scale on the viewfinder with the camera-to-subject distance.

Parallax correction is probably more important with this particular viewfinder because its body is higher above the camera lens than the bodies of other viewfinders. Thus, it is more important that the lines of sight of the viewfinder and camera lens intersect at the camera-to-subject distance used. Be careful not to bump the viewfinder out of adjustment, and don't forget to change the parallax adjustment when changing camera-to-subject distances.

SUBAWIDER II

The Subawider II Wide-angle Lens adapter is manufactured by Subatec of Switzerland, and distributed and serviced in the U.S. by Farallon/Oceanic (14275 Catalina, San Leandro, CA 94577). The molded, plastic body of the Subawider is a press fit over the front of the Nikonos 35mm lens. The rear edge of the Subawider body is slotted so it can spread slightly and grip the Nikonos lens. A setscrew isn't used, but the Subawider fits snugly and doesn't wobble.

The lens hood extends about one-eighth inch beyond the center of the dome port and gives the port some protection against accidental impacts. The four indentations on the lens hood should be aligned with the four corners of the picture area when the Subawider is placed on the Nikonos lens. This prevents the lens hood from showing up in the corners of your pictures.

Two decals, for the aperture and focus scales, are included with the Subawider. You attach these to the outer surface of the Nikonos lens mount, so that they fit around the control knobs. Calibrate the scales by placing marks (with paint or label tape) on the respective control knobs. The aperture scale shows each f stop, from f2.5 to f22, and the focus scale shows distance from 0.25 meters (9.8 inches) to infinity. The scales are easy to see — just look at them from the sides of the camera. The scales don't show depth of field.

The instruction sheet supplied by Farallon/Oceanic includes a complete depth of field table for combinations of distances from 0.25 meters, at apertures from f4 to f22. You can attach some basic combinations (such as f11 at three feet) to the side of the Subawider with labeling tape.

The viewfinder has a compact, molded plastic body and optics corrected for underwater use. The mount has two plastic sides that are squeezed in slightly when slipped into the Nikonos accessory mount. This holds the viewfinder snugly in place. A small rectangle is etched into the front port to show the picture area of a Nikonos 35mm lens. When the Subawider is used, the picture area is bordered at the top and bottom by frosted areas, and at the sides by the edges of the viewfinder.

Important correction. Due to a typing error, an early specification sheet specified the diagonal picture angle of the Subawider II as 95 degrees. Thus, in our April, 1980 article, we wrote that the Subawider widened the picture angle of a

(Continued on Page 82)

MANUFACTURERS SPECIFICATIONS

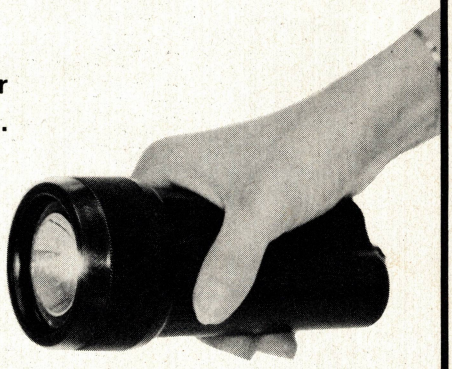
Lens	Focal length	Picture angle	Aperture range	Minimum focus	Price of lens	Price of viewfinder
Nikon 15mm	15mm	94°	f2.8-22	1 ft.	$1,359	$345
Sea-Eye 21mm	21mm	92°	f3.3-16	2.5 ft.	650	63
Sea & Sea 20mm	20mm	84°	f4-16	0.25m	N/A	N/A
Subawider II	N/A	90°	f2.5-22	0.25m	350	Incl.
Novatek 20	N/A	95°	f2.5-22	N/A	295	N/A

This information may differ from past, present or future published specs because of design or price changes. m=meters.

IKELITES

We have been asked if there is a diver or diving situation for which we do not make a light. Frankly, we cannot think of one. Our commitment to being the leader in underwater lighting requires our making available the widest possible range of underwater lights. We know that the diver will be able to find an IKELITE that best suits his or her individual needs. Our commitment in underwater lighting has led us to innovative designs such as our NEW MINI C-LITE, a small light with twice the intensity and coverage of similar size lights; our IKELITE II with its innovative on/off control, a light which has been the standard of the diving industry over the years; and our C-LITE series with its unique shape and compact size which is offered in two models. One is non-rechargeable and the second, a rechargeable model, is unquestionably one of the brightest diving lights in the industry. The MODULAR LITE series utilizes one light body for four lights. This one body accepts all interchangeable battery pack/bulb combinations; thus the simplest of MODULAR LITES can grow with your needs to the world's brightest diving light, the MODULAR SUPERLITE, or a MODULAR MOVIE LITE.

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IKELITE II



MODULAR LITE



C-LITE

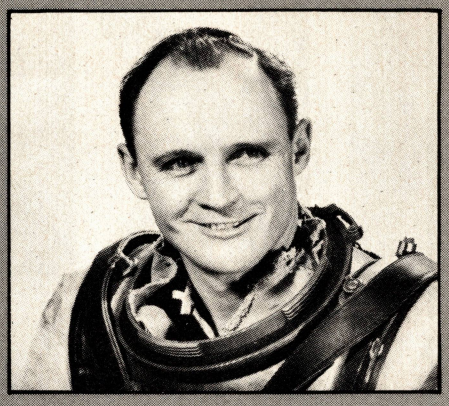
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Technifacts

BY E. R. CROSS



In the last two Technifacts it was pointed out that the most frequent underwater job a sport diver is called on to perform is one of search and recovery. For the commercial diver the most frequent job is one of inspection. This is also one of the easiest commercial diving job classifications for the sport diver to qualify for. However, the types of structures or installations requiring inspection are extremely varied and complex.

The method of inspecting the structures may be visual, by a free swimming or suited diver, from a one atmosphere dive suit, from a bell, by use of a manned submersible or a remote control vehicle.

For normal dive conditions to depths of 130 feet, the scuba equipped diver is preferred for most inspections because of the mobility and speed with which he can prepare for the job.

Many inspections of underwater installations are mandated by law. However, the owner-operator of an installation establishes inspection schedules designed to meet both legal and personal operating requirements. In all cases, inspections are extremely important because of the relationship between a sound structure and the safety of personnel, the potential for environmental damage, and the uninterrupted operation of the underwater installation.

Inspection may be a simple (comparatively) visual check of existing conditions or it may involve complex instrumentation, TV, ultrasonic instruments, electronic recording devices, or the use of chemicals and dyes. Regardless of the dive equipment or inspection techniques used, the findings of the diver must be accurate, complete and honest.

This Technifacts and those to follow in the next several months will cover inspection methods and techniques for underwater installations frequently encountered by the commercial diver. It is obvious that it is not possible to cover complete details on every kind of installation. Therefore, if you have a particular problem write to Technifacts. Every effort will be made to answer all questions.

SUBMARINE HOSES

In all the world's oceans, seas, and harbors there are thousands of tanker moorings and other installations where flexible rubber hoses must be used to bring a product from one place to another (from a tanker on the surface to a submerged, rigid pipeline and then to a refinery many miles away, for example).

Hoses installed for underwater use may be as small as two inches in diameter, or as large as a special 48 inch crude handling hose made by Kleber-Colombes of France. They may be semi-rigid for over-the-rail use or flexible for straight run sections. They usually sink, but floating hoses may be used for some installations. Also a special float/sink hose is made by Bridgestone Tire Company of Japan for use in a rigid tower tanker mooring system. Hoses used in marine work may be of any length but they will usually be in sections of either 25 or 30 feet.

United States Government regulations mandate that hoses used in marine installations be hydrotested and given a visual internal inspection and other tests on an annual basis. Most users of underwater hoses specify an external inspection by a diver on a monthly basis depending on use and nature of the bottom over which the hose is used, and following any unusual event that may cause damage to hoses — such as a severe storm. More on diver duties in this case in the next Technifacts.

Keep in mind the primary reasons for an underwater inspection are for the safety of personnel, ship, and pier; to prevent damage to the environment; and to maintain the hoses in a condition that permits continuous use. While expensive, the cost of divers to keep the hose system viable is minor when compared with demurrage charged by a tanker kept waiting because of hose problems.

HOSE CONSTRUCTION

Hoses are manufactured on a special mandrel to permit tight wrapping or fitting of each of the many layers. Basically, a hose will consist of two flanged nipples, short lengths of steel pipe, of appropriate lengths with raised ridges to hold the hose material to the nipple, and with flanges welded to one end. A tube of neoprene or other synthetic rubber of appropriate length is fitted tightly over the mandrel and the nipples to within a few inches of the flange. Over the tube is a layer of breaker fabric. Then comes 10 to 20 plies of fabric, followed by a layer of solid or stranded wire wound tightly around the nose assembly; another tube, and more layers of fabric, plus filler fabric between the raised ridges on the nipples and a binding wire to hold the tube and layers of materials to the nipple. The entire assembly, by now more than an inch thick in the main body of the hose and four to five inches thick over the nipple, is now covered with another breaker cloth layer and a rubber cover that may be from one-eighth to as much as one inch thick, plus a cap to seal off the layers at the end and a nipple cover to seal off the layers to the nipple. This makes for a really tough assembly that appears unbendable and unbreakable. However, the forces of the sea, the ship, and the sheer weight of the hoses can cause problems.

HOSE DAMAGE AND INSPECTION

Damage to a marine hose may be broadly classed into internal and external damage. Flange gaskets and valve fittings sometimes develop minor leaks also.

Internal damage may be the result of liner (the tube or first layer or the hose applied to the mandrel) wearing away, either partially or completely; liner separation from the nipple; internal bulging; or complete failure of the hose due to deterioration of the liner and the strength members of the hose.

Torn liners are usually caused by sharp objects picked up by the cargo pump system and carried through the ship's piping, and the hose gouging or tearing the liner. Owing to the velocity of the product being pumped through the hose, the lining finally rips completely out. Separation of the liner from the nipple is usually the result of stress on the hose, although such damage may also be at least partially owing to poor quality control during the construction of the hose. Occasionally a small hole may develop in the liner of a hose, permitting a small amount of product to lodge between the liner and the body of the hose. This causes a bulge in the liner to develop, restricting flow and eventually resulting in the complete failure of the hose. Chemical reactions between the product and the rubber in the hose may also cause weakness and failure of the liner and the hose. Reformate and other aromatic products cause very rapid deterioration of the rubber unless the rubber in the hose is specially compounded for

(Continued on Page 86)



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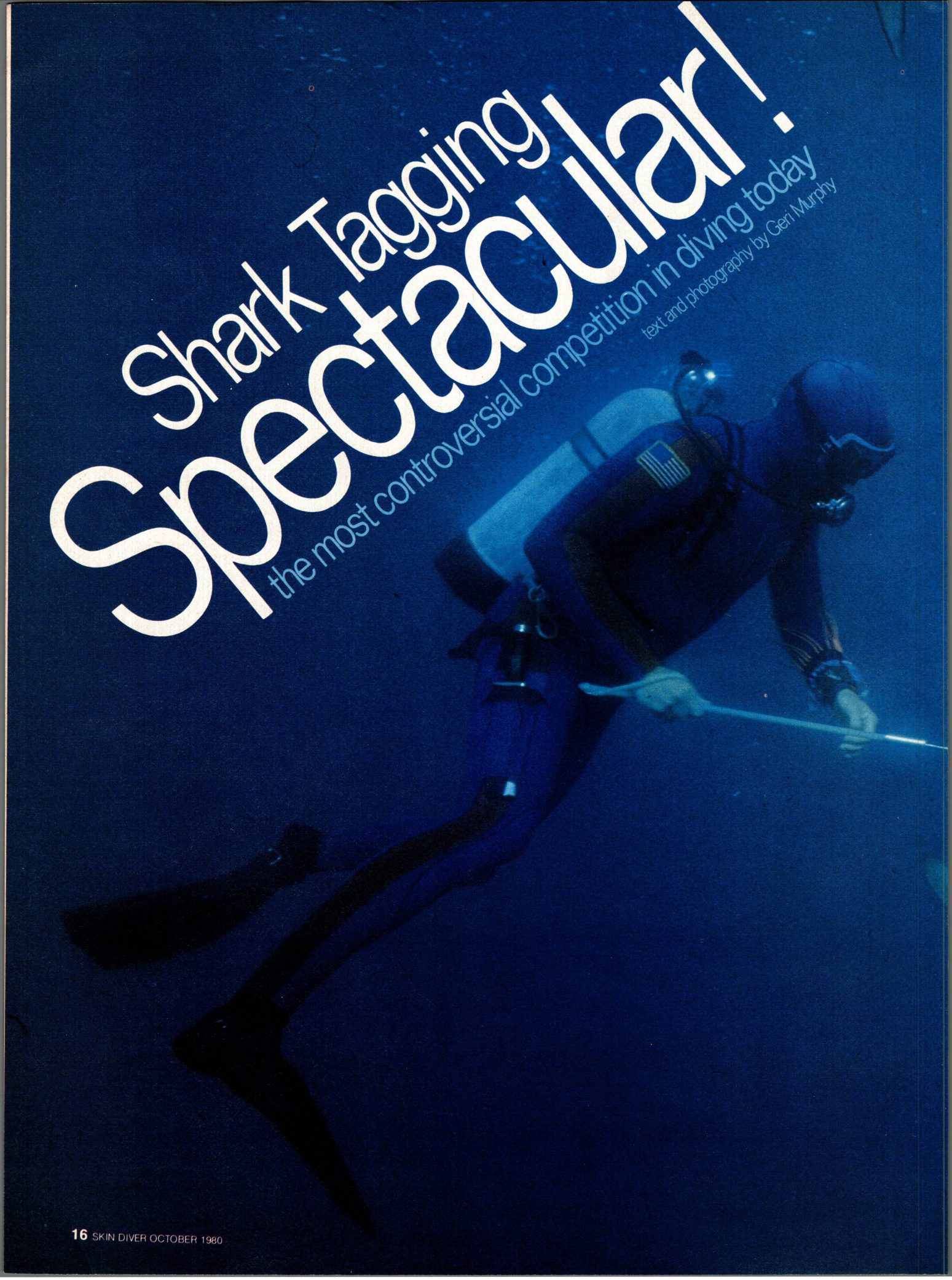
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text and photography by Geri Murphy





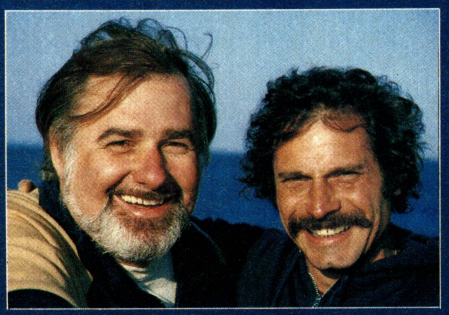
UNITED STATES TEAM
Jack McKenney & Chuck Nicklin



AUSTRALIAN TEAM
Ron & Valerie Taylor



WEST GERMAN TEAM
Herwarth Voigtmann & Helmut Debelius



Above, competition judge, Paul Tzimoulis, and producer/director, Stuart Goodman. Left, a shark beats a hasty retreat after Jack McKenney scores another tag in the dorsal fin.

Shark tagging has got to be the most controversial contest ever devised in the history of scuba diving. Most divers view it with either disdain or envy: Opinions of this unique tournament vary widely.

To many divers, shark tagging is lunacy on the high seas. They view it as a stupid stunt which could be as dangerous as playing baseball with a hand grenade. To them, there is no reason on earth for a group of adults to attempt to play underwater tag with unpredictable beasts that could snap off a hand or a foot in a split second. Yet, on the other side of the fence, there are many divers who find the shark tagging contest an imaginative event which calls for daring, skill and an extremely cool performance under stressful conditions. These divers regard the movements and behavior of sharks with utter fascination, convinced that man may be standing at the threshold of understanding an animal that has survived more than 300 years of evolution. And, of course, non-diving spectators find this event absolutely incredible. The thought of people deliberately swimming with a dozen hungry sharks is both horrifying and enthralling.

Whatever your viewpoint on this topic, one must admit that the contest is gaining credibility because of the divers involved. This event has attracted competitors from three different continents and now involves almost half of the world's top shark divers.

The site chosen for this year's shark tagging event was a point 50 miles northwest of San Diego, in the deep channel which runs between San Clemente Island and the Southern California mainland. Averaging 2000 feet in depth, this channel is reputed to be full of sharks in the summer months. The species of shark most frequently seen in this area is the blue shark, which ranges in length from four to eight feet. The blue shark is a long and slender creature, normally slow swimming and curious, but nonetheless considered dangerous. The blue shark has been known to bite divers on occasion, particularly when there is live bait in the water.

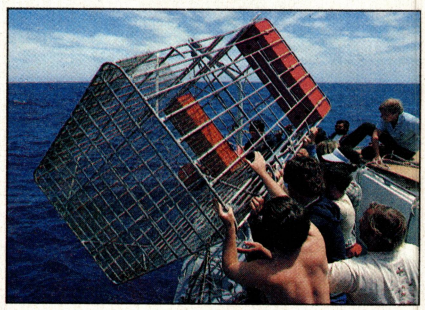
A crew of 35 technicians and divers converged on San Diego to prepare for the event. The competition was televised by CBS Sports for a weekend Sports Spectacular show. Field producer and director was Stuart



Dive coordinator, Howard Hall, explains the positions of the boat, chum line and shark cage to the judge and various contestants.



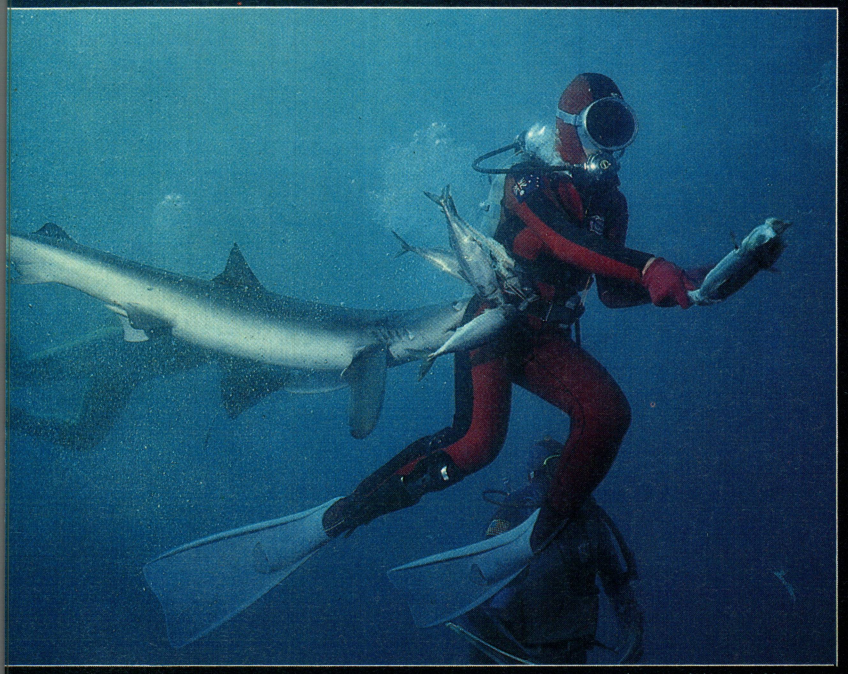
Judge Paul Tzimoulis announces the final scores to anxious team members after reviewing the video tapes on board the *Sand Dollar*.



The deck crew carefully lowers the shark cage into the water. The cage held the contest judge, SDM's own Paul Tzimoulis.



Left, Herwarth Voigtmann places a tag on his spear while holding two mackerel. Above, a shark displays yellow and blue tags that scored points for West Germany and the U.S. Below, a shark stealing a mackerel from Valerie Taylor.



photograph by Jack McKenney



One of San Diego's best known dive charter boats, the *Sand Dollar*, served as home base.



The galley of the *Sand Dollar* was converted into a control room for monitoring and recording the competition for television use.

Goodman, the original creator and developer of this unusual contest. Dive Coordinator for the 1980 competition was Howard Hall, a well-known underwater photographer and author of many SKIN DIVER Magazine articles. Howard was one of the competitors representing the U.S. in the previous shark tagging competition, staged two years earlier in the U.S. Virgin Islands. Assisting Howard with the underwater camera work was Gordy Waterman, Howard's teammate in the earlier competition. Other safety divers and underwater technicians involved in the event included: Larry Cochran, Marty Snyderman and Steve Earley; all veteran blue shark divers familiar with the area and the animals involved.

The shark tagging event took place aboard the *Sand Dollar* and the *Bottom Scratcher,* San Diego's two best known dive charter boats. Close to one-half million dollars in television monitors and video tape equipment was set up in the galley of the *Sand Dollar*. The *Bottom Scratcher* carried the competitors and the judge for the contest. Special equipment included a large shark cage, two underwater color television cameras, topside video cameras, special television recording equipment, TV monitors, and electronic cables.

The shark tagging competition rules devised for the event are perhaps the most bizarre in the annals of sport diving. One might describe this event as an undersea variation of Pin the Tail on the Donkey, except this donkey bites!

The shark tagging contest was an invitational event, restricted to professional divers with extensive experience in the handling of sharks at close range. Three competing teams consisting of two divers each were invited to represent the countries of Australia, West Germany and the U.S.

A shark cage was lowered into the water to a depth of 15 feet and suspended from floating and tethered buoys. The cage became the central point of the event. The competitors could stray no further than 25 feet from the cage, and no deeper than 15 feet below the floor of the cage. The reason for this restriction was simple— the cameramen were to film the contest from the same vantage point as the judge who was inside the cage. If the competitors tagged sharks that were beyond the visibility of the cameras or judge, the points were not counted. Since the purpose of the event was entertainment, all action had to occur close to the camera. The competition director and official judge, Paul Tzimoulis, was stationed inside the cage to observe each tagging and score the contestants.

Official Marine Fisheries tags, supplied by the Scripps Institute of Oceanography, La Jolla, California were used.

(Continued on Page 66)

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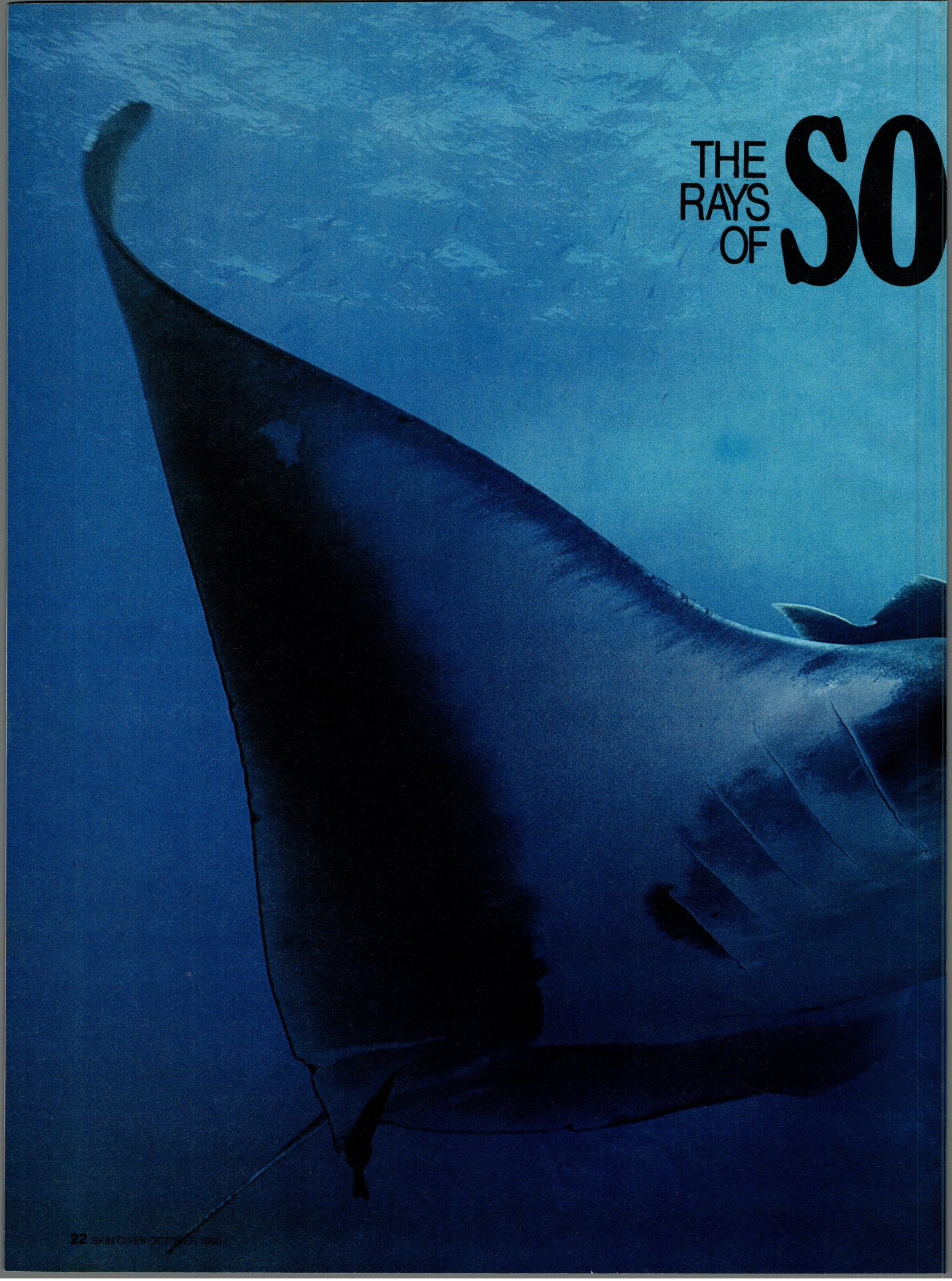
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THE RAYS OF SO

CORRO

Heart Pounding Excitement Erupts From Volcanic Archipelago South Of Baja California

Text and Photography by Howard Hall

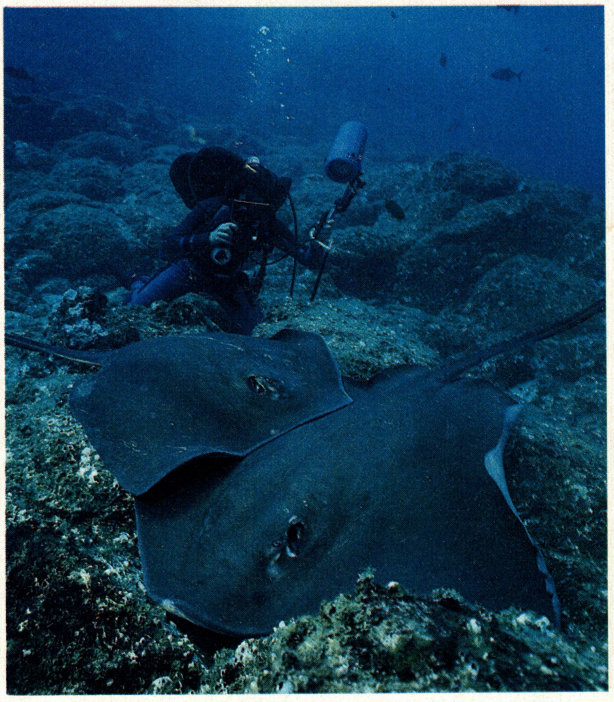


Very few sport divers had been to the Revillagigedos Archipelago. I had been told to be prepared for high winds, heavy seas, giant fish, massive concentrations of enormous sharks and a shortened life. The professional fisherman who gave me these happy hints told me bluntly that no one in his right mind could possibly want to dive there! I responded that I was entirely prepared. I had my motion-sickness pills for the heavy seas, my cameras for the sea monsters, and as for the possibility of a shortened life, perhaps I was nuts. In any case, after talking with the fisherman, I felt safe in assuming that the trip to the Revillagigedos Archipelago would be rather exciting.

The Revillagigedos Archipelago is a group of four islands several hundred miles south of the Baja Peninsula. The closest of these to Cabo San Lucas is Benedicto, at about 220 miles. The next island in the chain, and the largest of the group, is Socorro, which lies about 60 miles south of Benedicto. Southwest of Socorro is Partida (little more than a group of large wash rocks), and the most distant island is Clarion, about 370 miles from the tip of Baja. I didn't have long to consider the pitfalls of an exploratory trip to Socorro (our primary destination). The owner of the *Baja Explorador*, Ted Waltham, called me on the phone from La Paz three days before he intended to leave. Ted gave me a few quick details and said, "You wanna go?" Before I answered, I reviewed all the piles of work and assignments that I had lined up for the next two weeks. A tenth of a second later I replied, "Of course!!" It had been a relatively easy decision, even had I not dreamed of diving Socorro for years.

One of the nice things about exploring an infrequently dived area is that the rumors you hear can be very inaccurate. Fortunately this was partly the case with Socorro. Our weather was absolutely magnificent. The wind was calm, the Pacific swell was all but nonexistent, and the sun shone from horizon to horizon. This is not to say that Socor-

This graceful manta ray, attracted by divers in the water, seemed to glide through the water in effortless slow motion. Below, San Diego diver, Marty Snyderman, photographs two stingrays.



ro doesn't get its share of rough weather. On the contrary, during the summer months, nearly every hurricane the Pacific generates collides with Socorro. According to the military commander of the small Mexican base there, the summer hurricane season is five months long. In the winter, strong winds and heavy waves render these islands non-divable most of the time, but during the fall and spring there occurs a rather predictable weather window. After researching the weather charts, Ted had determined that the month of November is the ideal time for the trip, and to ensure against an untimely hurricane he examined daily satellite photographs right up until we departed. As for the sea monsters, they were there but they were not as intent on devouring us as we were led to believe.

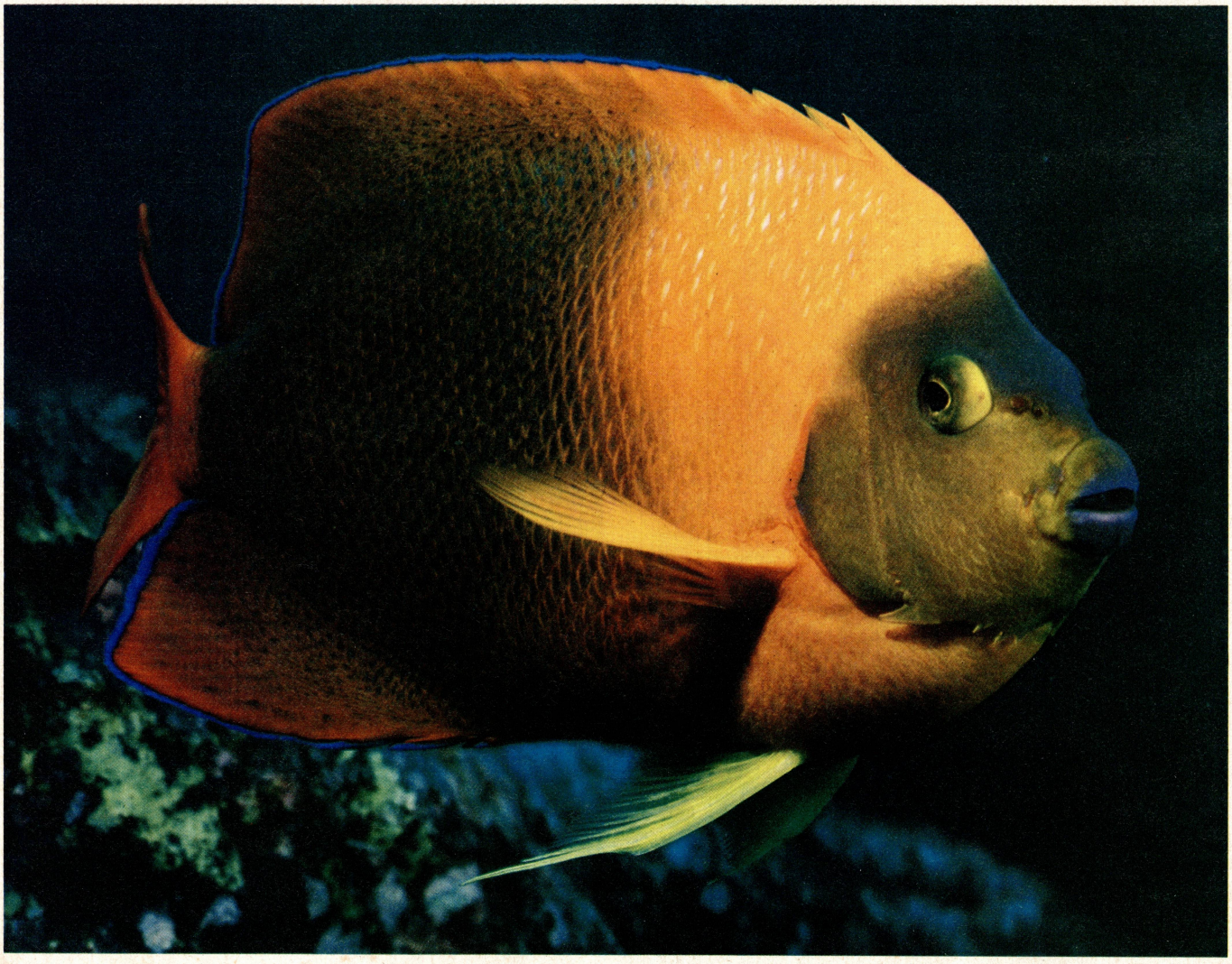
The five and one-half days we dived during the trip was a dream come true! The sights we saw would have caused my chin to fall to my chest on numerous occasions, had I not had a regulator in my mouth. To give you the flavor of what the diving was like, I will tell you about two dives we made, one at Benedicto and one at Socorro.

My dive buddy, Marty Snyderman, and I made our very first dive at the north end of Isle Benedicto. We left the *Explorador* by skiff, chose some wash rocks at the north end of the island as a likely hot spot, and told the skiff operator where we wanted to go. As we rounded the island, we had a good opportunity to examine Benedicto in the warm early morning light. The island is little more than a recently constructed cinder cone which last erupted in 1952. There is no life save a few tiny, dry bushes, no water, no shade, and the rest is cinder dust and ash.

Marty and I had been in the water less than 30 seconds before we saw our first manta ray, and 60 seconds later we saw our second. What absolutely incredible creatures. Neither Marty nor I had ever seen one before. They look as if designed by the producers of *Star Wars* rather than by Mother Nature. The mantas must have been attracted by seeing us, or by the sound of our bubbles, because they would appear in the distance and come straight at us. Then at the last minute, the rays would flare, do a 90 degree turn and glide away. It is awesome to be approached by an animal of that size. These rays were between 12 and 18 feet across. They look like huge prehistoric birds as they pass effortlessly through the water with slowly flapping "wings." They seem to be moving in slow motion until you try to keep up with them.

Marty and I realized this might be our golden opportunity of the trip and we were not about to spare any amount of physical effort in capturing the mantas on film. Two rays were willing to cooperate and we were determined to push our endurance to the limit to take advantage of this sudden windfall. One of the rays did a 90 degree turn right above me, momentarily blocking out the sun. Then it went into a glide. The manta's wings were extended out straight and totally motionless. Since the ray was not moving, I decided to swim beside it and continue shooting photographs, but I didn't realize how hydrodynamic these creatures are. Even without moving, the ray could glide faster than I could swim. After a few minutes of swimming at my top (and negligible) speed, I was exhausted and gave up.

Marty and I went through our air supply twice as fast as normal on that first dive. We both knew that if we got acceptable photos of manta rays now, we could consider the trip a suc-



cess. Who knew when we might get another opportunity to dive with such creatures? Little did we know that we were to see manta rays on *every single dive* we would make at Benedicto and Socorro.

I should also mention that we saw a few other things on that first dive at Benedicto. In addition to the mantas, we saw huge schools of 20 to 80 pound jacks, a 300 pound yellowfin tuna, a Galapagos shark, a silky shark, and a half dozen bottlenose dolphins. We made four more dives at Benedicto that day and each was a blockbuster! The next day we were to depart for Socorro (our primary destination), and we had high hopes for the remaining dive days. We were not to be disappointed.

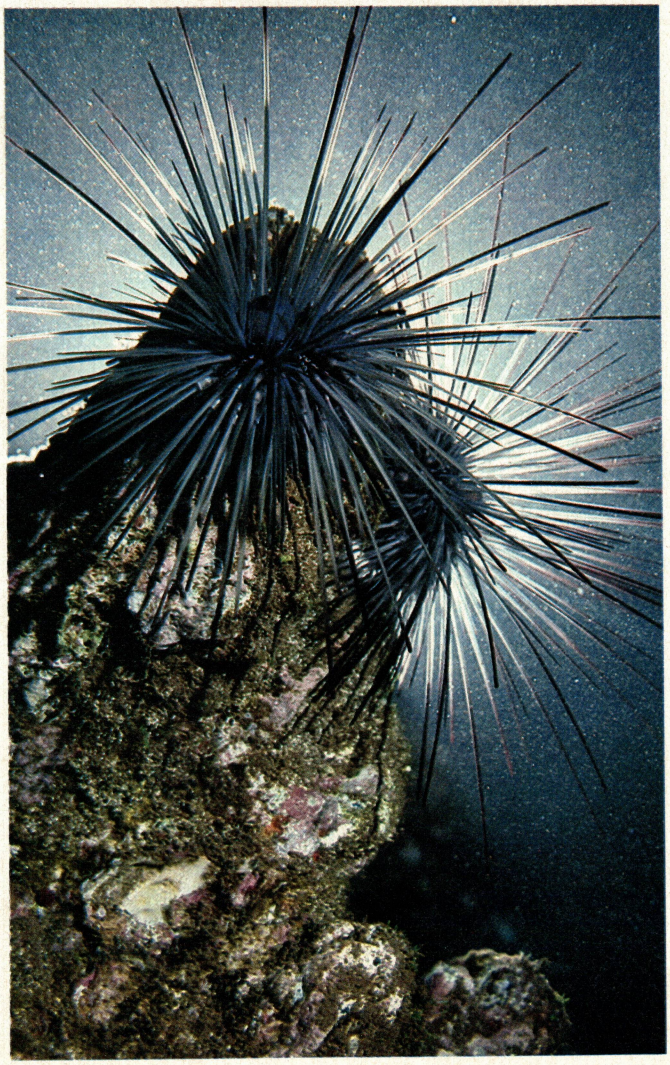
Socorro is a large volcanic island ten miles across, with green vegetation, fresh water, and some palm trees. The top of the island, at 3000 feet, is nearly always wrapped in clouds and in many ways reminded me of the dry sides of the Hawaiian Islands. It looked like a lovely place to build a summer house except that hurricanes would blow it down a half dozen times a year.

It has always been my experience that the best diving is to be found on the most unprotected sides of reefs or islands — this was especially true at Socorro. The lee side was like a huge clear aquarium with nothing in it. There were small numbers of fish representing only a few species, and other than sea urchins, almost no invertebrate life. We made several dives on the lee side and each time were astounded by the lack of life. Of course, the mantas livened up these lee side dives considerably; their presence was nearly perpetual. The absence of invertebrate life is also very conspicuous on the windward side, but the diving is anything but boring!



Our best dive of the trip was made at the very north end of Socorro (the most unprotected point) at a place called the Islets, which are two large rocks about three miles off the island. The roughness of the water there discouraged us at first, but after inspecting the bottom with snorkeling gear we decided it was safe to dive. Marty and I found a shelf at 45 feet surounded by deep water, and decided that this might be a good base of operation. We had brought a large, dead fish along

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Seen and photographed infrequently, the Clarion angelfish is easily recognized (far left). Sea urchins, with special backlighting, become quite photogenic (left). Top, the largest island in the Revillagigedos Archipelago is Socorro, some 280 miles south of Cabo San Lucas off the tip of the Baja Peninsula. The other three islands in the chain are Benedicto, Partida and Clarion. Above, scorpionfish eyes photographer malevolently.

The Oceanic Whitetip Shark

(Carcharhinus longimanus)

The single major characteristic that separates the sharks and rays from all other fishes in the ocean is the fact that their skeletons are made entirely of cartilage instead of bone. Therefore, sharks and rays are classed together as Chondrichthyes (cartilaginous fishes) and the others are classed as Osteichthyes (bony fishes). Shark expert Richard Ellis writes that the two distinct lines of evolution probably began in the Silurian Period, some 400 million years ago. □ The oceanic whitetip shark (*Carcharhinus longimanus*) has been called, "the undisputed lord of the tropical oceans," by Cousteau; "the most dangerous shark in the world," by a number of shark experts — even more dangerous than the great white shark (*Carcharodon carcharias*) — and shark biologists Lineaweaver and Backus report that it may be the most numerous large animal in the world, large meaning over 100 pounds. The fact that there are more oceanic whitetips than great whites may be the basis of its more dangerous reputation: Man is more apt to run into an oceanic whitetip. □ The oceanic whitetip is found in almost every ocean of the world, usually far offshore in the open sea. It reaches a maximum length of 12 to 13 feet, though Ellis reports that it usually grows to no more than eight feet. There are certain physical characteristics that readily distinguish the oceanic whitetip from every other shark in the world. First and perhaps most important are its enormously long pectoral fins. *Longimanus* means long hands, and is an extremely suitable species name. Cousteau called the shark, "Lord of the Long Arms," because of this characteristic. Other distinguishing features are its rounded first dorsal fin (in other sharks this fin is usually pointed) and this fin and all other fins of the shark, are tipped in white or faded so markedly at the tips as to appear white. The shark also has a short, broad snout. A non-physical characteristic of the animal is that it is almost always accompanied by at least a few — but usually a swarm — of the black and white striped pilot fish, *Naucrates ductor*. □ The behavior of the oceanic whitetip shark has been described in every way possible, from indifferent to nasty, but the majority opinion considers it an extremely dangerous shark. John McCosker of the Steinhart Aquarium calls it, "scary and aggressive." Photographer Roessler described the shark in his photograph, opposite, as "deliberate . . . a careful, careful animal." He got into the water with the shark and as he began photographing at the surface the shark began to circle, wide at first but ever narrowing. "He made the ocean smaller and smaller," said Roessler, "until at the end of an hour the shark had come so close I had to push him off with the camera. At that point we got out of the water. That was it!" □ The oceanic whitetip is a member of the family Carcharhinidae, which includes gray sharks, reef sharks and requiem sharks. Because of its singularly long pectorals, the oceanic whitetip for a time had its own name, *Pterolamiops*. Carcharhinids are characterized as having a nictitating membrane, a third eyelid. Sharks have upper and lower eyelids but these are stationary, immovable. The shark has to rotate its entire eye behind these eyelids for protection, but in carcharhinids the nictitans, or third eyelid, may be brought into use if the eye is physically endangered. □ Oceanic whitetips have been described as appearing "very dirty." They are not silvery or blue like many sharks, but grayish brown to ochre above, lighter below. Cousteau describes the species as ". . . absolutely hideous. His yellow-brown skin color is not uniform, but streaked with irregular markings like a bad job of military camouflage." The oceanic whitetip is not to be confused with the reef whitetip shark, *Triaenodon obesus*, which also has the white tipped fins but which is a near-shore shark. The oceanic whitetip ranges the open ocean, worldwide, and is notorious for being the first to arrive at a disaster site at sea. The animal is primarily a carnivore but, like the great white, has a reputation for eating anything in its path.

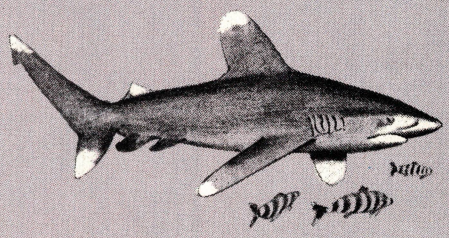


Photo By Carl Roessler - Text By Hillary Hauser

Roessler photographed this 5 to 6 ft. shark in the Red Sea one mile from land, in water 2000 ft. deep. He used a Nikon F, 24mm lens, in a Niko-Mar housing, Farallon/Oceanic 2001 strobe. F5.6, 1/60 sec., 3 feet from subject.





Florida's Fabulous Treasure Fleet

1715 Spanish Plate Fleet continues to yield undreamed of wealth

Text and Photography by Robert Weller

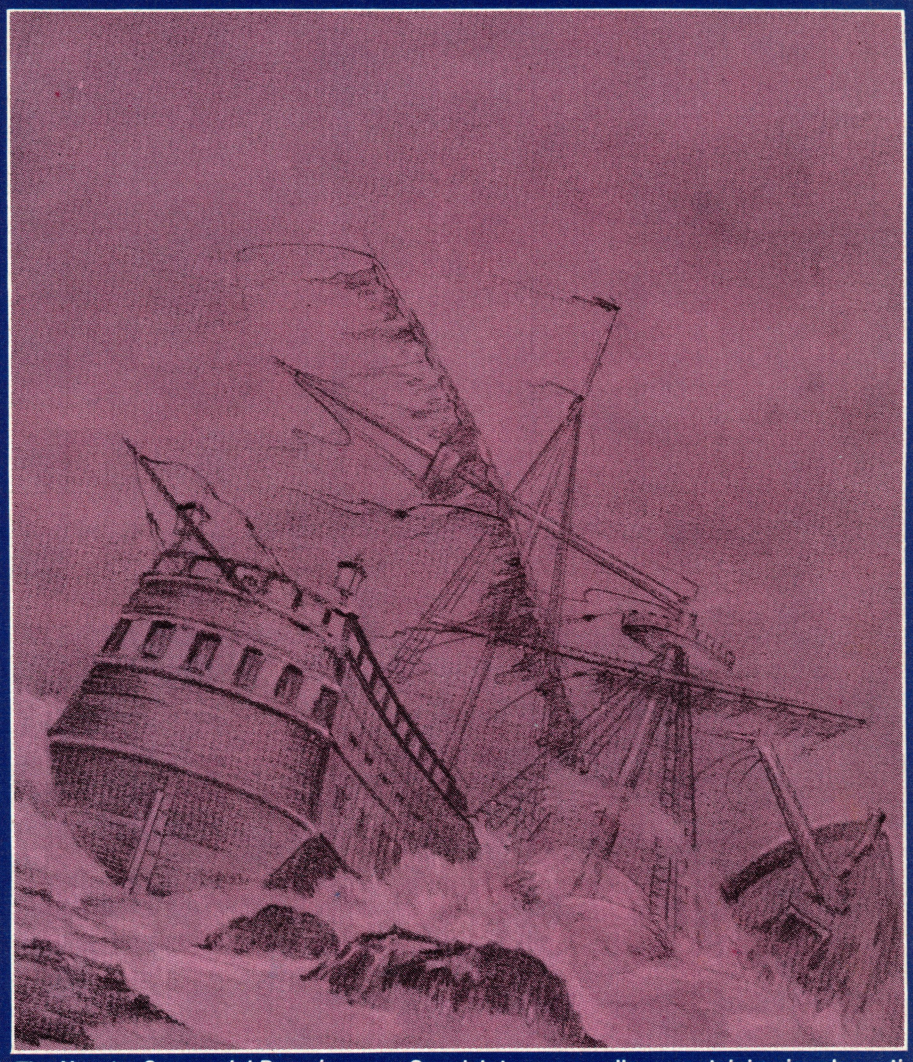
With blood, sweat, money and technology the diver works a treasure site until frustration and endurance become inseparable. Almost as the decision is made to toss it all, the sea gives up some of its treasure, and you're hooked!

The sound of the steadily throbbing boat engine directly overhead began to increase, and the surge of water directed at the ocean floor before me was like a waterspout in reverse. The pressure on my back felt as if I had picked up a bag of cement to keep me from being blown out of the treasure hole I was working. The limited visibility I had a moment ago was gone as the bottom of muck and clay came apart as if exploding. I was in foggy darkness, and the only sanity left was the electronic probe I held in my right hand, sweeping the bottom I could no longer see, and the occasional beeping of the amplifier strapped between my shoulder and chin. For the next 30 minutes I would fight the urge to burst for the surface and daylight, and instead, concentrate on swinging the metal detector back and forth along the edge of the expanding treasure hole ten feet below the surface of the Atlantic Ocean. And before this day was over we would find our treasure, one of the most significant recoveries by treasure divers in recent years.

This particular treasure hole was located three miles south of Ft. Pierce inlet, Florida, and belongs to what we think might be Admiral Echeverz' *Nuestra Senora del Rosario*, one of the Spanish treasure galleons that sank during a hurricane in 1715. It was on this site that Mel Fisher became a treasure legend by recovering over $5 million in gold and silver coins during the 1964-70 Florida treasure boom. When the coins began to thin out, Mel moved his group further south in search of the *Atocha*, and other groups of treasure salvagers moved in over the site to fish for leftovers. Some were able to pay for expenses, others came away empty-handed. No one hit it big, and no one stayed around for more than a year or two. In 1978, with a Florida state salvage contract in hand, Richard MacAllaster moved his Peninsular Exploration and Salvage Group onto the site. His objective that first year was to learn as much about the wrecksite as possible— it lay scattered over 80 acres of ocean bottom. If he found treasure that would be the icing on the cake. This is a difficult wreck to work, stretching from the water's edge to depths of 40 feet or more, and over a bottom that changes from wormrock to razor-sharp pinnacles of reef scissored with fissures leading off in all directions. All of this wrapped in a blanket of sand and clay ranging from a few inches deep to several feet.

You can stand on the dune line and see the three reefs that stretch parallel to the beach. The first reef, just beyond the breakers, shows white water and the third reef is a brown line some 800 yards out to sea. In between, the second reef rises where you least expect it, and often within a foot or so of the surface. When maneuvering a large salvage boat, like our 45 foot *Bamboo Bay*, into this area you are in constant danger of putting a hole in its bottom. With the fetch of open water at your back, large waves roll across the reefs putting the boat on its beam ends and making it difficult to hold a position. Everyone is constantly on the alert for a change in the weather, as well as tide changes. Currents move swiftly along the reefs making it necessary to anchor on three points, not only to hold the boat over a position, but to keep it from swinging against the Dragons Teeth just a foot or two below the surface. The galleons always managed to smash their bottoms open on the outer reef, then drift across and sink in between the Dragons Teeth where salvage is difficult. That's the challenge to treasure divers!

That first year we set up permanent benchmarks on the beach, and made one of the most comprehensive detail charts of the area ever developed. MacAllaster based the chart on a precision overlay of anomalies; a result of many days of carefully sweeping the area with a sensitive magnetometer from the stern of the *Bamboo Bay*. To this overlay he added information gleaned from previous divers, and from the official State of Florida log kept during the initial salvage years. We picked excellent reference points and by carefully sighting angles between two pairs of separate benchmarks, we were able to return to the same bottom position each time within a foot or so, keeping us from covering the same area twice. We all worked hard that first year but still came away with little more than expense money. The total treasure recovered was nine gold coins, 1578 silver coins, and a number of artifacts; including two gold and three bronze rings.



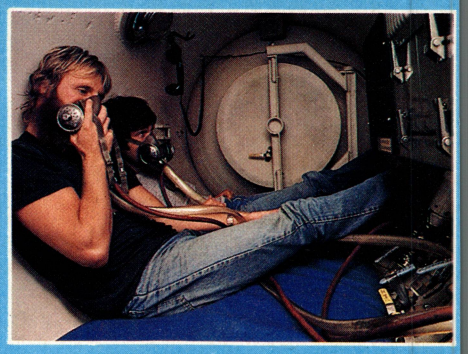
The *Nuestra Senora del Rosario* was a Spanish treasure galleon containing jewelry, artifacts, and gold and silver coins. She sank in 1715, 3 miles south of Ft. Pierce inlet, Florida.

The most important lesson to come out of the 1978 operation was that if there was any treasure left it was covered by wormrock, squirreled away in fissures of the reef, or close to the surfline where a black muck covers the blue-green clay bottom making visibility impossible when using a blower to move the sand cover. What we needed was a metal detector

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Left, a diver locked-out of bell in dive tank. Above, a diver in a hot water suit returns to deck. Above right, divers decompressing in the main lock of deck decompression chamber. Right, diving supervisor talks to a diver with the use of a communication box.

BELLS

The hatch of the diving bell dropped open; a diver wearing a band mask, hot water suit, and bail-out bottle emerged, pulling an umbilical behind him. He moved quickly away from the bell and stood on the bottom, then suddenly collapsed. Moments later, a second diver — equipped as the first — slithered out of the bell, grabbed the incapacitated diver by his harness, and pulled him back to safety. In short order he pushed his inert companion up into the bell, then followed himself. The hatch closed and the bell began to ascend.

On the surface, the bell was quickly clamped onto a deck chamber. A technician in the control van opened a valve to bring the pressure in the transfer trunk up to that of the bell; the divers climbed down into the entry-lock and removed their hot water suits. On the TV monitor in the control van the hatch into the main chamber swung open and the divers came through. As soon as the hatch was sealed behind them, decompression began.

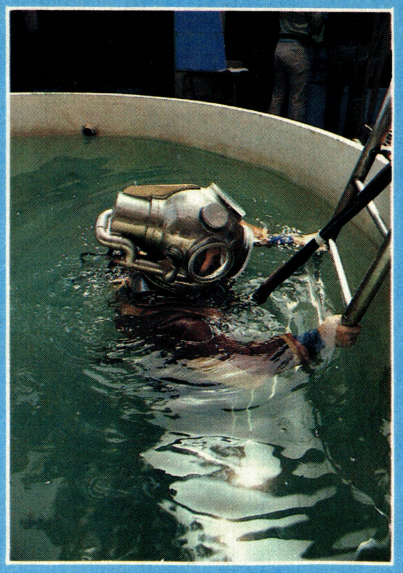
The procedure I had just witnessed was a training exercise and had not taken place on a remote offshore oil rig, but at the new facility of the Marine Diving Technician Program at Santa Barbara City College in California — one of only two colleges in the U.S. to offer a two year course in industrial diving.

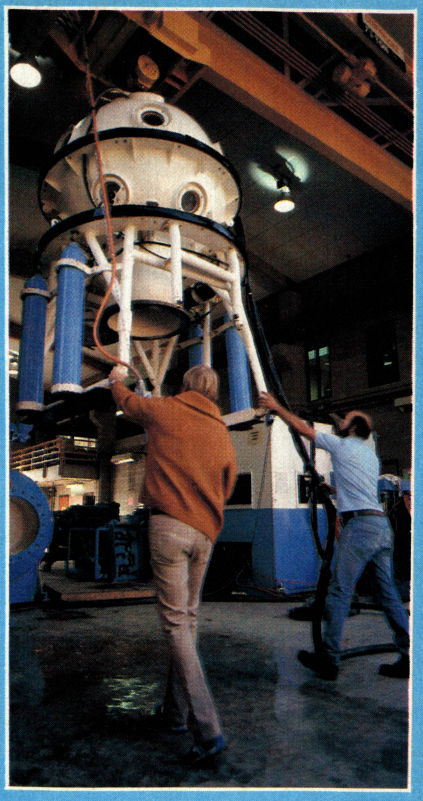
Within a few months, the second year students I had been watching would graduate and join commercial diving companies in areas such as the U.S. Gulf Coast and the North Sea — two of the world's most active offshore oil regions. For weeks and months at a time they would live far from land on platforms, barges, floating rigs, and dive vessels. The work would revolve around the installation, inspection, and repair of platform jackets, risers, pipelines, monobuoys, and other components of an offshore oilfield. Depths would range from just under the surface to more than 650 feet. The students would start out as tenders but, before long, would be in the water: Making shallow air dives at first, then going deeper on mixed gas. A year later they might be in saturation — living under pressure for as much as 30 days at a time.

Started in the fall of 1968 with Sea Grant funds, the Marine Technician Program graduated its first class of 30 technicians in June, 1970. The reaction of the commercial diving companies was highly favorable and the program quickly established a solid reputation. Several members of the original class are now in top management positions in this country and abroad, and regularly hire graduates from the school.

According to Robert Christensen, department chairman, the continuing success of the program owes a great deal to the close contacts that are maintained with all branches of the professional diving community and to the continual feedback from former students. The needs of the industry and the effect of government regulations are the factors that shape the curriculum, which is constantly reviewed by an advisory committee composed of representatives from many branches of business, industry and education. Training in bell and saturation systems was incorporated into the program several years ago as a result of the rapidly increasing use of such equipment by dive contractors. Similarly, students are required to take an Emergency Medical Technician (EMT) course to meet the in-







Left, a diver descends for an inspection dive. Above, a hardhat diver with a helium recirculator helmet descends into the tank. Right, moving the bell to the deck decompression chamber is a two man job for students of the Marine Diving Technician Program.

BOLTS & BRAINS

A college program in Commercial Diving at California's Santa Barbara College

Text and Photography by Chris Swann

dustry's need for greater medical preparedness offshore. The EMT course exceeds Occupational Health and Safety Administration (OSHA) and U.S. Coast Guard requirements.

The new Marine Technology building, designed specifically for the program, opened during the 1978/79 school year. The layout is strikingly functional. A large shop area opens onto two dive tanks located outside the building, and is equipped with an overhead bridge crane running the length of the facility and out over either tank. Heavy equipment, such as the diving bell, can thus be picked up in the shop and moved to the dive area. Storerooms and locker rooms are located on one side, at ground level, with offices and a large classroom above. Apart from the bell saturation system, the building contains an impressive collection of compressors, jet-pumps, hydraulic units, a standard double-lock decompression chamber, various types of marine engines, and even a submarine wellhead — known as a Christmas tree. The total inventory of the college's equipment exceeds $400,000 and was either purchased under the original Sea Grant, or donated by companies such as Ocean Systems, Exxon, Diving Systems International, and Kinergetics.

The curriculum at Santa Barbara City College consists of three types of courses: The first to develop skills and technical knowledge; the second to provide an understanding of the ocean environment; and the third to increase general knowledge and communication ability. The value of a two year program can be appreciated when one realizes that employers now look for a high level of technical education, as well as mechanical ability. The days of the high school dropout are long gone. Students at City College take courses in technical physics, electronics, oceanography and marine biology — as well as learning manual skills. They are also taught to write technical reports and to communicate effectively in group discussion.

Contrary to what some may think, only a small portion of a diver's time is actually spent underwater. Surface dives are usually made on a rotation basis and few divers spend much more than 60 days a year in saturation. The rest of the time is spent working on deck, or assembling equipment ashore. For this reason, a diver has to have a wide range of technical abilities. The Santa Barbara City College curriculum includes: welding, machine shop, seamanship and small boat handling, fundamentals of marine engines and compressors, and drawing and blue print reading. In the course of an average month offshore, a technician is likely to use every one of these skills — whether setting up a job, making repairs, or doing routine maintenance.

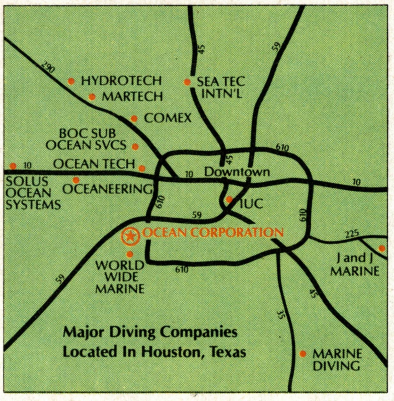
Today's oilfield diver must be able to use a wide range of dive gear — from scuba to bell systems. When the Marine Technician Program first started, heavy gear was prevalent offshore and much of the training was done in this equipment. Now lightweight gear has generally replaced heavy gear. Training at City College starts out with scuba — paralleling the 100 hour course given by the University of California — and then moves on to tethered gear: In this case, Kirby-Morgan Band Masks with bail-out bottles. During the second semester students continue working with full facemasks, but are also introduced to swimable helmets such as

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Why Houston?

BECAUSE

The Ocean Corporation is located in Houston and more commercial divers are hired in Houston than in any other place in the world. Twelve diving companies are located in Houston including three of the four largest in the U.S. Many others are located in the nearby New Orleans area.The demand for divers is so great in Houston that large locally based diving companies like Ocean Systems, Hydrotech Systems, Martech International and Sea Tech International have hired many of our students for part-time work while they were attending school. Over 90% of our recent graduates went to work for these and other local diving companies when they completed our program. Houston is the place where the action is...the commercial diving, offshore construction and oil industry capital of the world.



BECAUSE

The Ocean Corporation is a commercial diving company, not just a school. Our facilities, equipment and training aids are the best, and our diving systems are as up-to-date as possible... because much of the equipment is used by our diving operations division to perform actual diving contracts in the field. Ocean Corporation has successfully completed many underwater jobs for various industrial clients over the years... including specialized underwater inspections, maintenance and repair work. For example, we did the world's first commercial underwater repair job in a nuclear power plant. And most of our divers have been graduates of our own school.



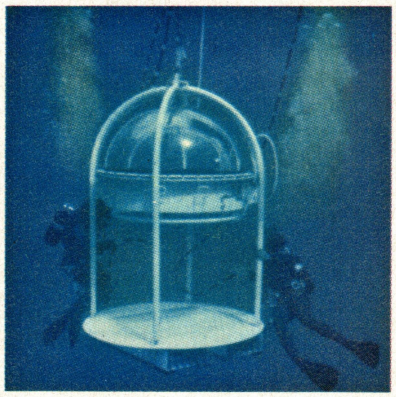
BECAUSE

The Ocean Corporation is a convenient and exciting place to go to school. Houston is one of the fastest-growing and most dynamic cities anywhere. It is a city of expansion, energy and youth (the average resident's age is in the mid-20's). Houston offers every conceivable kind of entertainment, from sports events, ultra-modern discos and open-air theater to rough-house local rodeos, chili cook-offs and the new Texas-size country-western dance clubs. Reasonably priced adult and singles apartments are readily available within walking distance of the school, and fast-food to luxury restaurants are nearby. The semi-tropical climate is wonderful, the sport diving is great and the folks are friendly.



BECAUSE

The Ocean Corporation management and instructor staff have long-term experience in the international offshore oilfield diving business. Retired ex-military divers and sport scuba divers don't run the school...*commercial* divers do. For example, the President of The Ocean Corporation, Larry Cushman, was Vice President and Europe/Africa Area Manager for Ocean Systems, Inc. for three years...with responsibility for all North Sea diving and underwater construction operations. He also worked six years as a manager for Oceaneering International, Inc., another of the world's largest commercial diving contractors. Ocean Corporation managers and instructors know today's diving business...first-hand, from recent experience.



COMMERCIAL DIVER ★ THE OCEAN CORPORATION ★

TheOceanCorporation

5709 Glenmont • Houston, Texas 77081

School of Commercial and Industrial Diving

If you are interested in becoming a commercial diver, please write and ask for our free information package on job opportunities, our school and our super city. If you'd rather call, make it collect and ask for Fred Tourtel (713) 661-0033.

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40 Horsecollar Buoyancy Compensators Are Rated

Text and Photography by Marty Snyderman

Next Month: Back-Mounted and Wraparound Compensators

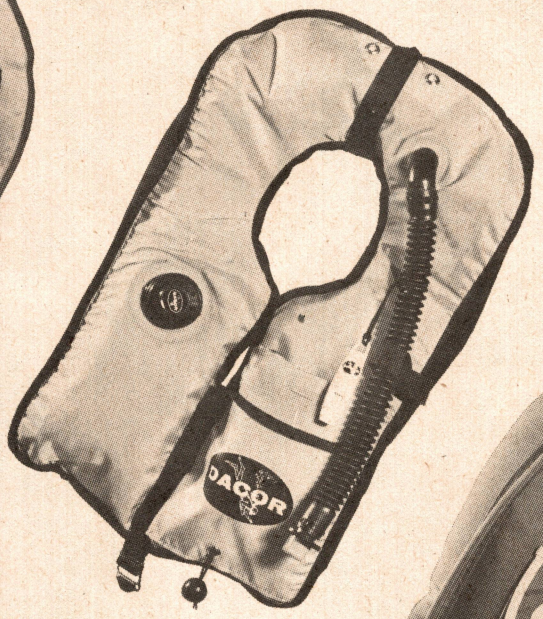
BC roundup



AMF Swimaster, GBC-1



Cressi-Sub, 733



Dacor, CV25



Cressi-Sub, 741

There is one piece of dive equipment that is mostly responsible for allowing you to: rest comfortably on the surface; slow down or stop your descent easily; hang suspended in neutral buoyancy; adjust your buoyancy precisely; return to the surface with a bag full of lobsters or abalone; and swim on the surface easily and comfortably. This piece of equipment can also serve as a flotation support in an emergency situation, helping you to either receive or give assistance if necessary. I am referring to your buoyancy compensator, or BC as it is commonly called.

BC's play a major role in dive safety, fun, comfort, and overall efficiency in the water. Not too many years ago their introduction as a standard part of every diver's equipment caused great controversy. Everyone from instructional agencies, to manufacturers, to the U.S. Navy had strong opinions as to whether or not compensators were necessary or beneficial. Today, however, BC's are accepted by all recognized leaders in the sport diving field. The evolutionary process has seen this part of our equipment progress from a safety vest, to be used only in an emergency, to the present day compensators, viewed as working tools that serve a variety of functions. Buoyancy compensators have made diving safer, more fun, and within the reach of a greater percentage of the public than was ever thought possible. Paralleling this BC evolution, diving has changed from a physical endurance contest into a recreational activity enjoyed by more and more every day.

At present, there are literally hundreds of BC models and styles available to sport divers. At first glance, the thought of logically considering the various styles, with all of their optional accessories, might seem a bit overwhelming — but it can and will be done in this and next month's issues of SKIN DIVER. There are many models to choose from now, as compared to six or eight years ago. This is because in the past, dive equipment was for the most part developed for military purposes. It was often designed to fit 18 to 22 year old males who were not only in excellent physical condition, but who had certain physical characteristics. Candidates who might have made excellent divers, but who were considered too tall, too short, too stocky, too skinny, or the wrong sex did not qualify. Today, however, dive manufacturers realize that equipment needs are dependent upon height, weight, sex, and general build. Your comfort and dive pleasure will be greatly enhanced if you choose equipment suited to your favorite underwater activities, your type of diving, and your build. So pull up a chair, get comfortable, and let's take a look at BC's.

While there are numerous models of compensators to consider, all can be grouped into one of three categories ac-



Dacor, CV60



Dacor, BC1



Dacor, CV40



Dacor, BC4

cording to style. The categories are: horsecollar, back-mounted and wrapa-round.

Horsecollar BC's are often referred to as front vests, and occasionally called Mae Wests. Front vests were originally designed as safety vests. Horsecollar BC's are put on over the diver's head and encircle the neck, with the largest volume of the vest being over the upper part of the diver's stomach and chest. These doughnut-shaped vests fulfill the needs of both scuba divers and snorkelers, and there are more than 109 models, made by the 16 companies who participated in this study alone. Most of these compensators are constructed with a bag, or bladder, which can be inflated with air, or CO_2, for buoyancy control and surface support. Most BC's are more ruggedly built than safety vests, and consist of an outer shell which protects the one or more inner bladders which hold the air. Because the BC is constructed with one bag does not mean that it isn't durable, some of the more popular BC's have only one bag.

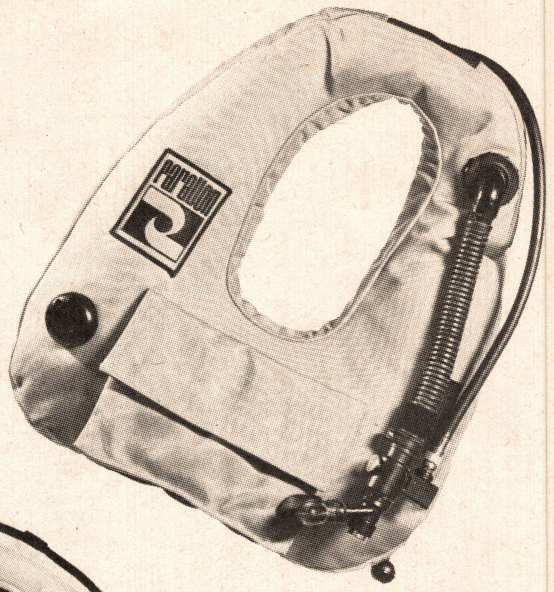
All compensators can be inflated either manually or orally. All have over-pressure relief valves, as well as a strap system that attaches the compensator to the body. Many BC's have an array of other features such as: power inflators, CO_2 cartridge detonating mechanisms, whistles, pockets, accessory rings, and color selections.

Many compensators can be inflated in an emergency with a CO_2 cartridge and this feature can serve divers well in the event that they become tired, have cramps, or feel as if they might lose consciousness.

On the surface, a BC should allow a diver to rest comfortably. Comfortably, according to instructors Bob Schaible of the San Diego Diving Locker and Dick Hammes of Mesa College, means physical comfort, as well as that the diver should be high enough in the water to remove snorkel or regulator and carry on a brief conversation. One of the major advantages of horsecollar-style compensators is that they will, according to many tests — including one recently conducted by James Middleton of the U.S. Navy Experimental Diving Unit in Panama City, Florida — float unconscious divers face up on the surface when inflated.

BC's work because of the laws of physics, as explained by Archimedes' principle which states that, "any object wholly or partially immersed in a liquid is buoyed up by a force equal to the weight of the liquid displaced." In salt water, if a diver weighs 190 pounds, including gear, and displaces three cubic feet of water, he or she will be two pounds positively buoyant. This is because a cubic foot of salt water weighs 64 pounds, meaning that three cubic feet weigh 192 pounds, and 192 minus 190 yields two pounds, positive. But as the

BC roundup



Farallon/Oceanic, Elevator II,
08-2000-2001



Farallon/Oceanic, Elevator III,
08-3000-3001



International Divers Inc.,
Balboa, 1772



Healthways, 1980

diver descends, pressure compresses his wetsuit and the diver displaces less water, becoming first neutrally buoyant and then sinking as he becomes negatively buoyant. The diver's weight remains unchanged and by putting some air into the compensator, the volume of displaced water can be increased and neutral or positive buoyancy can be achieved. As the diver ascends from depth, he may wish to vent off excess air to remain neutral.

The buoyancy provided by a compensator, when it is fully inflated, is usually expressed in pounds. Any BC will provide approximately ten percent more lift in salt water than in fresh water. Not all manufacturers state whether the buoyancy for their compensator is for salt water or fresh water but tests that yield close approximations are relatively easy to conduct. Simply fill the compensator at the surface and determine how much lead weight is needed to sink it, or find how much weight a fully inflated compensator will lift off the bottom. All manufacturers who participated in this roundup make at least one compensator that has more than 35 pounds of lift.

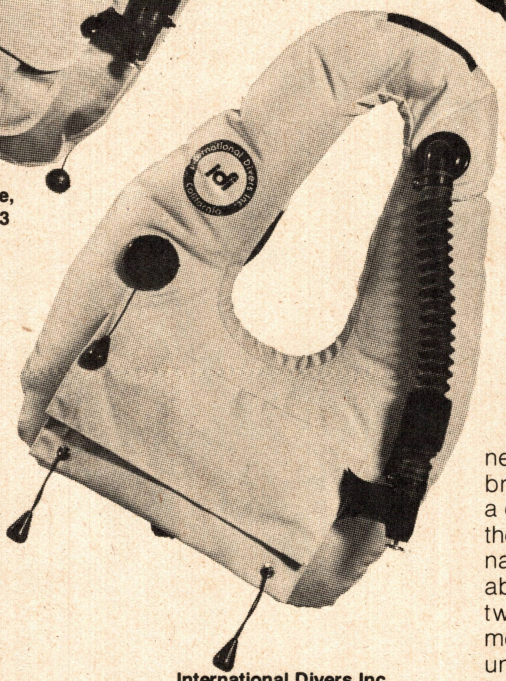
When considering the style and features that will suit you best, a review of dive techniques may be helpful. Good dive habits dictate that you check-out your equipment before heading for the beach or boarding your boat, and your BC is no exception. You should orally inflate the unit, making certain that the mouthpiece is not rotten and is securely held in place. Check the inflator/deflator mechanism to make sure it depresses and lifts easily. To check for leaks, simply leave the compensator inflated for at least five minutes. If it remains fully inflated, which is likely, you have no leak problems. If it even partially deflates, you had best check and see if the oral inflator is stuck in the open position; if the dump valve or over-pressure valve is leaking; if the check valve in your CO_2 detonator needs repair; or if the bladder has been punctured. Your local dive shop can help you repair any problems. In continuing the check-out process, you should hold the inflated compensator against your stomach and squeeze it to make sure the over-pressure relief valve is working. All straps, buckles and clips from the harness system should also be examined. If your BC has a power inflator, hook it up and make sure both the inflation and deflation mechanisms work. If the vest has a CO_2 detonator, the mechanisms should be inspected, making sure the firing pin moves freely and far enough to puncture the cartridge. The firing pin toggle cord should be examined and if need be, replaced. Cartridge threads and detonator threads should be cleaned if necessary, and the CO_2 cartridge should be checked to ascertain if it has been discharged. The entire procedure takes only a few minutes, and a little preventa-



Parkway Fabricators, Sport Deluxe, VES14433



Parkway Fabricators, Economy, VES11131



International Divers Inc., Newporter, 1771



Parkway Fabricators, Sport, VES13121, VES13132

tive medicine here can save you a lot of frustration later.

Once at your dive site, the straps should be adjusted with your wetsuit on and the vest fully inflated. If you adjust the harness with the compensator deflated, you are likely to suffer a painful case of crotch squeeze as the unit inflates. Keep in mind that the closer the compensator fits to your body, the better buoyancy control you have. Make sure your buddy understands how your inflation and deflation mechanisms work; how your CO_2 cartridge is fired; and how the strap system works.

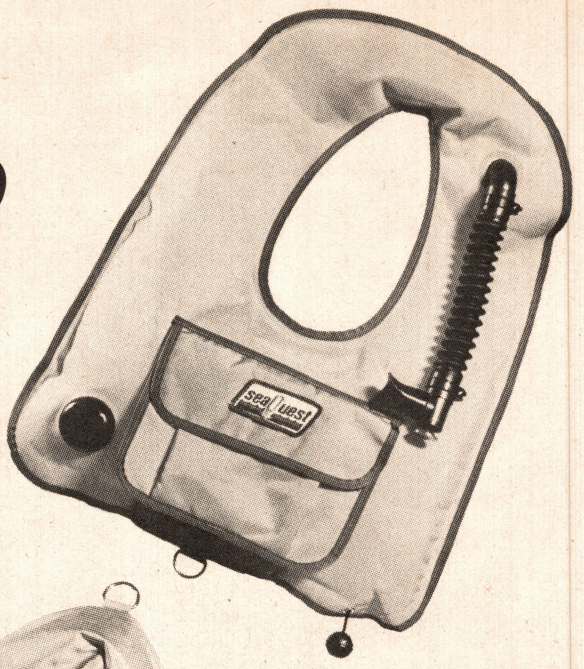
Horsecollar BC's are attached to divers in several different ways, and it is very important that your weightbelt can be dropped without becoming entangled in the straps. The strap systems for front vests, back-mounted BC's and wrap-around compensators are significantly different. When horsecollars are used, most instructors say that the BC is donned first, then the tank and pack, and finally the weightbelt.

Whether entering the water from a boat or from the beach, inflate your BC to about two-thirds of its capacity. When using a horsecollar BC, resting on your stomach while on the surface is usually most comfortable when the vest is partially deflated. How much to deflate is a matter of personal preference, but inexperienced divers are often uncomfortable because they continually try to lie on top of a fully inflated vest. Some people prefer to rest on their backs, but they need to be on the lookout for big swells or breaking waves. Weightbelts tend to pull a diver's feet down, while front vests pull the head up. Rather than fighting this natural effect, it is often more comfortable to rest in a position somewhere in between horizontal and vertical. Remember, your BC should not ride so high under your chin that it restricts your breathing.

Once ready to descend, the cardinal rule is never begin to deflate your BC until your second stage is in your mouth. It is possible to vent most front vests when lying on your stomach, your back, or when upright by simply holding the mouthpiece of the inflator/deflator hose higher than the rest of the vest, and activating the deflator. On the majority of compensators, a diver must use the left hand to deflate. Some experienced divers prefer to use the dump valve to descend quickly in surface currents, but this is generally considered an advanced technique. For most divers, a controlled, foot-first descent using conventional venting is preferred.

Once you start down, remove your hand from the deflator. If the compensator is empty, closing the valve will prevent water from filling it. Clearing will be easier if you descend slowly rather than just pulling the plug. As you descend, your suit will begin to compress and you will be-

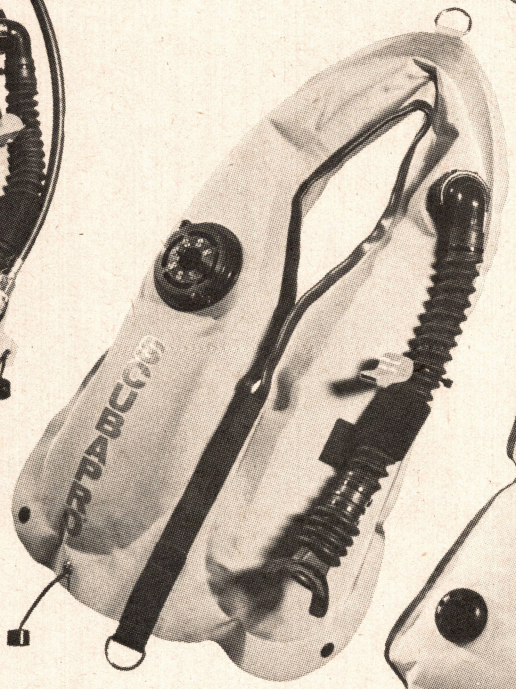
BC roundup



SeaQuest, Open Water II, 9402



Scubapro, BC
21-020-000,
21-021-000



Scubapro, Mark I, 21-567-000



SeaQuest, Shortie BC, 9406

come heavier. It will therefore take more energy and air to retain your position. In order to trim your buoyancy you can, if your BC has a power inflator, inflate the unit with a series of short bursts until you reach the desired state of buoyancy. If you use an automatic inflator, you never have to remove your regulator from your mouth. Many instructors believe that most divers use less air when they inflate their BC's mechanically, than they would using a series of half breaths to fill the vest and clear the regulator.

By using your BC intelligently, you can trim your buoyancy in any manner you choose.

You can also use your BC to assist you when ascending. Use a series of half breaths, or a series of quick inflations to begin to fill your vest and take the elevator to the surface. A word of caution against becoming a totally dependent, push button diver: You should never get into a situation, (too deep and too heavy with too little air) where you cannot reach the surface by kicking. And too, good instructors insist that you practice orally inflating your BC even if you have a power inflator. A power inflator is intended to be used as a tool to make your diving easier and more fun, but not as a crutch upon which you are totally dependent.

It is also extremely important to keep in mind that you should ascend at a rate of no faster than 60 feet per minute. When ascending, the air inside your compensator will expand, as will your wetsuit, and you will ascend at an increasingly faster rate unless you vent off excess air. While most instructors agree that compensators which have up to 55 pounds of lift are excellent pieces of equipment, divers must understand how to prevent too rapid an ascent which can lead to such injuries as air embolism or the bends. By leaning back or laying out so that the deflator hose is held open and high above the compensator, you can deflate your compensator rapidly enough to prevent getting bounced to the surface. Recently conducted Navy tests have shown that most front BC's can be sufficiently vented in 4 to 16 seconds and the Navy concluded that this amount of time is adequate for their purposes. The point is that today's BC's will vent rapidly enough so that you can control your ascent rate as long as you are familiar with your equipment and practice using it.

The practice of making a series of intermittent stops between 30 feet and the surface is becoming more and more accepted, and if you are properly weighted and know how to utilize your BC, the skills necessary to make these stops can be easily mastered.

Once on the surface you should inflate your BC, either orally or mechanically, until you are comfortable and easily able to keep your head out of the water. If you or your buddy has a problem on the surface, or if you are just a little more tired



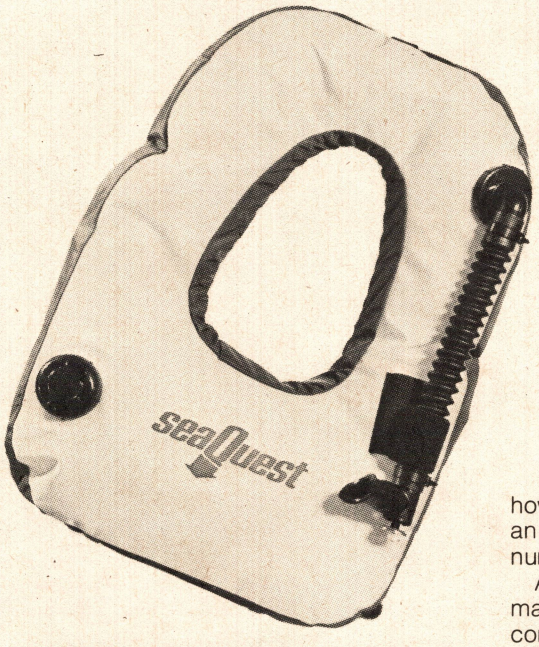
SeaQuest, M-96BC, 9496-9497



SeaQuest, M-94 BC, 9494-9495



SeaQuest, Deep Water, 9412-9415



SeaQuest, M-90 BC, 9490-9491

than you'd like, you can inflate your BC with the CO_2 mechanism. All you need to do is pull the toggle cord, detonating the cartridge. It should be understood that CO_2 cartridges are designed to be used on the surface in emergency or near emergency conditions and not at depth. Boyle's Law states that the volume of a gas is inversely proportional to the pressure exerted upon it. Thus, the deeper you are, the less lift you will get from a detonated CO_2 cartridge. And, the size cartridge utilized in most compensators will not provide a significant amount of lift at depth. In an emergency on the surface, however, use the CO_2 detonator — it is an easy and inexpensive way to solve a number of problems.

After your dive, only a small amount of maintenance is required to keep most compensators in excellent working condition. Manufacturer's instructions should be followed, but all they usually require is that you rinse both the inside and outside of the BC in fresh water, and lubricate the moving parts. The inner bladder(s) can be rinsed by running a stream of fresh water from a garden hose into the inflator/deflator hose while the valve is open. The BC should then be hung up while fully inflated for a couple of hours, and then turned over and drained through the hose. If a compensator has zippers they should be lubricated with a silicone stick, and the CO_2 detonator lubricated with silicone spray. Both of these lubricants can be obtained at your local dive shop. The BC should then be stored partially inflated, and hung up out of direct sunlight and away from intense heat or cold. You should also avoid folding or creasing the bladder when storing, as well as storing the compensator near sharp objects that might puncture the bladders.

Now, let's take a closer look at the design parameters and features of the horsecollar style vests available to today's divers. Horsecollars can be subdivided into two groups, safety vests and compensators. Safety vests are intended to be used as a surface support by free divers. Compensators are, on the other hand, designed to be used by free divers and scuba divers, both as a working tool at depth and on the surface as a support for divers who need to rest, or who have an emergency arise and need added flotation at the surface.

The design and construction of dive compensators is a bit complex. In April, 1976, SKIN DIVER published the following design parameters for horsecollar BC's to be used by scuba divers.

1) All buoyancy compensators must be able to support a diver at the surface with the head clear of the water. Each horsecollar BC must fit over the head and around the back of the neck, doughnut style.

2) All must be capable of being orally

BC roundup



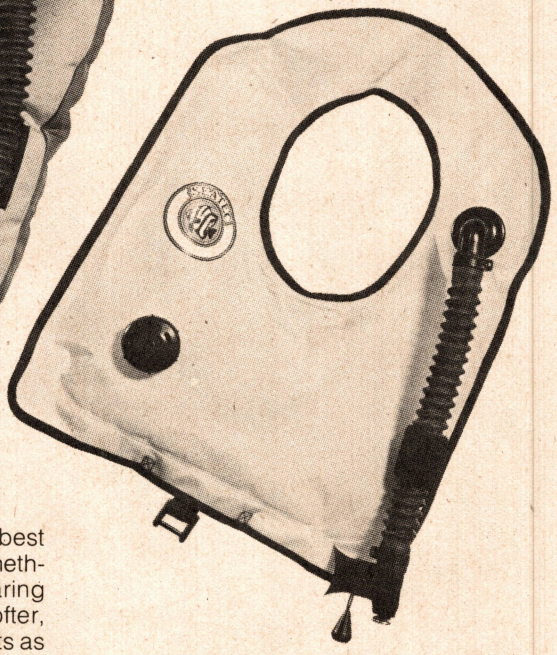
SeaQuest, Rough Water, 9420-9427



SeaQuest, White Water, 9464-9469



Seatec, Puffer, 10412-01



Seatec, Perch, 10284-51

inflated.

3) All must be mechanically inflatable, either by an attached refillable air tank or by a low pressure hose from the main scuba system.

4) Each unit must have an over-pressure relief valve.

While these parameters still apply, the construction of horsecollar compensators and the materials used vary from manufacturer to manufacturer and in some cases from model to model. Scubapro's compensators consist of a single bag system made of a heavy-duty, rubberized nylon outside, with a rubber bladder inside. These compensators are taped and glued so all seals are guaranteed. All other manufacturers make their units out of multiple bag systems. The outer bags or shells which protect the inner bladders and help the compensator maintain its shape are usually made of a tough ballistic nylon, as in the cases of Farallon/Oceanic and Seaquest; a tough Cordura nylon or a polyurethane coated armornyl nylon in the case of Selpac; or a denier nylon fabric that is heavily coated with urethane in the case of Seatec. Seatec utilizes two types of nylon for their shells. One is the 1000 denier, which Seatec refers to as, "Tough Tiger Threads" and the other is 420 denier nylon. The numbers 1000 and 420 refer to the size of the yarn. A feature to consider when trying to decide which is the best compensator for your purposes is whether or not the vest has rough-wearing nylon on exposed surfaces and softer, smoother nylon at body contact points as is the case with some BC's made by Parkway.

Inner bladders are generally made of urethane or polyurethane and technology has advanced to the point that some experts claim that, "neither bacteria, hydrocarbons, ultraviolet rays, nor chlorines will affect the new polyurethane materials." These bladders are for the most part ultrasonically welded to prevent leaks and the final products are puncture resistant and long lasting. Dacor's Seachute series utilizes two internal bladders, one for air and one for CO_2. Each has its own oral inflator, over-pressure relief valve, and dump valve. Both also have CO_2 inflator mechanisms, but the tests are designed so that one bladder is usually used for an emergency device and the other as the main ballast in the compensator system.

Although this is unlikely, if you do puncture an inner bladder, it can be easily removed through the zippered opening in the neck and replaced at a reasonable cost. Also, some inner bladders can be repaired.

When diving, it is likely that some water will gather between the outer shell and the inner bladder of multiple bag BC's. A drainage system in the bottom of the cover will allow water to drain quickly and save you the effort of carrying around a



Selpac, SBC44



Sportsways, 2012



Seatec, Sunfish, 10396-01



Selpac, SBC32

few cubic feet of seawater as you prepare to remove your gear after your dive. Larger drains and more surface area make the draining process quicker. Some compensators even have drains in the pockets. Mesh drains are usually larger and drain faster than eyelet drains. Grommets, or eyelets, at the top of the shell are, however, an excellent idea as they allow air to escape from between the shell and inner bladder upon descent.

As mentioned earlier, there are three possible ways to inflate horsecollar compensators; orally, with a power inflator, or with a CO_2 cartridge. The oral inflator on a well designed vest should be easy to find, and once found, it must be easy to use. Most horsecollar compensators utilize Velcro tabs to attach the inflator hose to the vest. This is an excellent feature, but you must keep the Velcro relatively free of debris so the tabs will stick together. Practice finding your inflator so you know how to replace it on the velcro tab in case you knock it loose. Weighted inflators sink and are easier for most people to locate than inflators that float. The inflator mouthpiece should be comfortable, easy to use, and distinctly different from other mouthpieces such as those on regulators, snorkels, or inflatable suits. Designs vary greatly from manufacturer to manufacturer. Dacor has two inflator hoses, one with a "lip-stop coldwater" mouthpiece. By placing his or her lips around the mouthpiece and pushing down to break the seal, a diver can inflate the BC and not get a mouthful of water. Water accidentally let into the vest is also held to a minimum. On Dacor's Seachute models, the second inflator is a different design. It is similar to those of most safety vests in that it must be pulled up to open the valve seat and the hose has a much smaller diameter. The inflator hoses of most safety vests are made of a significantly stiffer rubber, while the more flexible, spiral design of the inflator hoses of diving compensators affords excellent drainage. Other oral inflators have a finger or thumb operated push button to open the valve and the diver's lips are simply pressed against the mouthpiece. You insert Farallon/Oceanic's inflator into your mouth to orally inflate the BC. U.S. Divers' mouthpiece is a unique tube design which is used the same way.

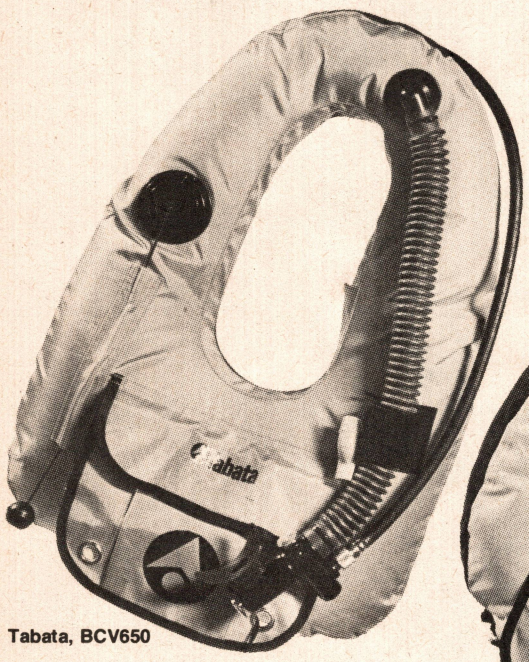
The optional power inflators are worthy of some discussion in any present day review of compensators, but an in-depth look at the various models is beyond the scope of this article. Most power inflators use air from the tank, reduced to low pressure by the regulator, to inflate the BC. Most power inflators are designed to be operated with the diver's left hand. An exception is U.S. Divers' mechanical inflator. It is affixed to the lower right hand side of the BC and is best operated with the right hand.

U.S. Nemrod utilizes a separate

BC roundup



U.S. Divers, Aqua Master BCV, 7778-00-7779-50



Tabata, BCV650



Sportsways, 2010/2110-2000/2100



U.S. Divers, BC707-706

cylinder with which to mechanically fill the Push-Lift-S BC. The four liter bottle attaches to the compensator, is manually controlled, and can be filled from a scuba tank.

Not all power inflators fit all BC's. Your dive shop can help you buy the proper piece of equipment for your system. Safety vests will not accommodate power inflators— they are intended to be used without tanks.

U.S. Navy tests have shown that inflation of most compensators uses only nominal amounts of air. The range varied from .50 cubic feet to 4.25 cubic feet and no BC tested required more than 5.9 percent of the air in a 71.2 cubic foot tank. It is the opinion of many experts that intelligent use of a power inflator will conserve air during a dive: Less energy and effort is expended than during oral inflation and neutral buoyancy is easier to achieve. The Navy tests further concluded that competent divers could inflate all the BC's tested in 6 to 25 seconds. Variations in fill times were directly related to the BC's lifting capacity and the design of the inflator mechanism.

All compensators come equipped with at least one over-pressure relief valve. There is one for each gas-holding bladder. If it were not for the over-pressure relief valve, a BC filled at depth would expand to its structural limits and then burst like an over-filled balloon during ascent. The over-pressure relief valve opens automatically, allowing excess gas to escape. Most of these flapper style valves open when internal pressure is between 1.5 and 2.5 psi above ambient pressure. The valves do require some common sense maintenance. Sand, crystallized salt, or other debris can cause the seat to stick in the open position. An old or defective seat has the same effect. If the valve leaks, it can be rather quickly disassembled and cleaned, but old or defective parts must be replaced.

Many, but not all, compensators employ the use of a manually operated dump valve, which enables you to quickly deflate your BC. Dump valves are optional features and should not be confused with over-pressure relief valves, although some manufacturers combine the two rather neatly into one that can serve both functions. Instead of being automatically opened by a spring, dump valves are opened by a variety of manual methods. Cressi-Sub and Seatec, for example, use a hand-pulled toggle cord, while Scubapro prefers to use a rod-like handle.

If you suspect a leak in either an over-pressure relief valve or a dump valve, fully inflate the compensator and then squeeze it while listening for leaks, or submerge the inflated vest in water and look for bubbles. Most manufacturers ask you not to lubricate the rubber valve seats because the lubricant can cause the seat to displace itself. Because both over-pressure relief valves and dump valves sometimes leak, many experts

HORSECOLLAR BC ROUNDUP

MANUFACTURER	NAME AND/OR MODEL NUMBER	NO. OF BAGS IN SYSTEM	BUOYANCY LBS/LITERS	POWER INFLATOR	DUMP VALVE	STRAP AND MOUNTING SYSTEM	EMERGENCY DEVICES	COLOR	SUGGESTED RETAIL PRICE
AMF SWIMASTER	6BC1	2	40 lbs., SW	no	yes	waist, crotch to waist	25 gm CO2	limegreen/black	$110.00
	6BC2	2	25 lbs., SW	no	yes	waist, crotch to waist	25 gm CO2	limegreen/black	100.00
CRESSI-SUB	733	1	16 lbs., FW	no	no	waist	16 gm CO2	orange/blue	$ 64.00
	741	2	40 lbs., FW	no	yes	waist and crotch	25 gm CO2	orange/blue	106.00
DACOR	CV25	2	25 lbs., FW	no	no	underarm harness	whistle, 25 gm CO2	orange/black	$105.00
	CV40	2	37 lbs., FW	no	yes	waist, crotch to waist	whistle, 25 gm CO2	blue/black	125.00
	CV60	2	25 lbs., zipped 37 lbs., unzipped, FW	no	yes	front apron waist, crotch to waist	whistle, 25 gm CO2	orange	140.00
	BC4	2 inner	20 lbs., air only 25 lbs., CO2 40 lbs., both FW	no	yes, two for each bladder	waist, crotch to waist	whistle, 25 gm CO2	silver/black	165.00
	BC1	1 cover, 2 inner	28 lbs., CO2 42 lbs., air only FW	no	yes, air bladder	waist, crotch to waist	whistle, 25 gm CO2	silver/black	180.00
FARALLON/ OCEANIC	Elevator III 08-3000-3001	2	37 lbs., FW	no	no	crotch to waist	25 gm CO2	orange and blue	$140.00
	Elevator II 08-2000-2001	2	37 lbs., FW	yes	no	crotch to waist	25 gm CO2	orange and blue	175.00
HEALTHWAYS	1980	2	30 lbs., SW	no	no	waist, crotch to neck	25 gm CO2	orange/black	$ 95.00
INTERNATIONAL DIVERS INC.	Balboa, 1772	1	22 lbs., FW	no	yes	waist, crotch to neck	optional, 16 gm CO2	yellow/black	$ 60.00
	Newporter, 1771	2	45 lbs., FW	no	yes	waist, crotch to neck	Two 16 gm CO2	yellow	126.00
PARKWAY	Economy, VES 11131	2	33 lbs., FW	no	no	waist, split crotch to neck	25 gm CO2	orange/black	$ 90.50
	Sport, VES 13121, VES 13132	2	40 lbs., FW	no	no	waist, split crotch to neck	25 gm CO2	blue/black and orange/blue	102.50
	Sport Deluxe VES 14433	2	40 lbs., FW	no	no	waist, split crotch to neck	25 gm CO2	orange	120.50
SCUBAPRO	Mark I Diving Vest, 21-567-000	1	14 lbs., FW	no	yes	waist	whistle, 2 CO2 inlets	orange	$135.00
	21-020-000, 21-021-000	1	25 & 35 lbs., FW	***	yes	waist, crotch	whistle, 2 CO2 inlets	orange	135.00
SEAQUEST	Open Water II 9402	1	22 lbs., SW	no	no	waist, crotch to neck	16 gm CO2	orange/blue	$ 86.60
	Shortie BC 9406	1	15 lbs., SW	no	no	waist, spine/crotch	16 gm CO2	orange	67.25
	Deep Water 9412-9415	2	35 lbs., SW	optional	no	waist, spine/crotch	optional, 25 gm CO2	black and yellow	107.10-143.35
	M-90 BC 9490-9491	2	33 lbs., SW	no	no	waist, spine/crotch	optional 25 gm CO2	yellow	104.90-117.40
	M-94 BC 9494-9495	2	29 lbs., SW	no	no	waist, spine/crotch	optional 25 gm CO2	yellow	117.40
	M-96 BC 9496-9497	2	33 lbs., SW	optional	no	split top diamond, waist, crotch	optional 25 gm CO2	blue	119.30-155.55
	White Water 9464-9469	2	40 lbs., SW	optional	no	split top diamond, waist, crotch	optional 25 gm CO2	blue, yellow and silver	110.60-157.15
	Rough Water 9420-9427	2	40 lbs., SW	optional	no	split top diamond, waist, crotch	optional 25 gm CO2	blue, orange and silver	134.00-170.25
SEATEC	Perch 10284-51	1	15.5 lbs., SW	no	no	waist, crotch to neck	16 gm CO2	yellow	$ 58.00
	Puffer 10412-01	2	35 lbs., SW	optional	yes	diamond top, crotch to waist	16 gm CO2	6 color combinations	100.00
	Sunfish 10396-01	2	44.5 lbs., SW	optional	yes	diamond top, crotch to waist	25 gm CO2	6 color combinations	106.00
SELPAC	SBC 32	2	30 lbs., SW	optional	no	waist, crotch to neck	optional 25 gm CO2	orange, blue and yellow	$ 80.00-122.50
	SBC 44	2	42 lbs., SW	optional	yes	waist, crotch to neck	optional 25 gm CO2	blue, yellow and orange	109.50-151.50
SPORTSWAYS	2012	2	33 lbs., FW	no	no	parachute harness	26 gm CO2	yellow/blue	$ 95.00
	2010/2000-2110/2100	2	33 lbs., FW	optional	no	parachute harness	26 gm CO2	yellow/blue	139.00
TABATA	BCV-650	2	34 lbs., SW	yes	yes	waist, crotch to neck	whistle, 25 gm CO2	orange	$114.00
U.S. DIVERS	Aqua Master BCV 7778-00-7778-50	1	40 lbs., FW	no	yes	waist, crotch to neck	whistle, 25 gm CO2	yellow and blue	$ 87.00
	BC707-BC706	2	38 & 52 lbs., FW	optional	yes	waist, diamond crotch to neck	whistle, 25 & 38 gm CO2	yellow/black	123.00
	BC700-BC705 7700-7705	2	38 & 52 lbs., FW	yes	yes	waist, diamond crotch to neck	whistle, 38 gm CO2	yellow, black and blue	172.00
U.S. NEMROD	6724 BC24	1	18 lbs., SW	no	no	waist, crotch to neck	16 gm CO2	yellow	$ 90.00
	6726 BC26	2	40 lbs., SW	no	no	waist, crotch to neck	25 gm CO2	orange	135.00
	Push-Lift-S 6728	1	16 lts., SW	optional	yes	waist, crotch to waist	whistle, optional 4 liter bottle	orange	298.25-369.00

Notes: *** Scubapro buoyancy systems come without a mouthpiece or inflator system and Scubapro recommends that these be used in conjunction with Scubapro's Quick Disconnect Inflator #21-562-000 or A.I.R. II #21-009-000

FW = fresh water
SW = salt water

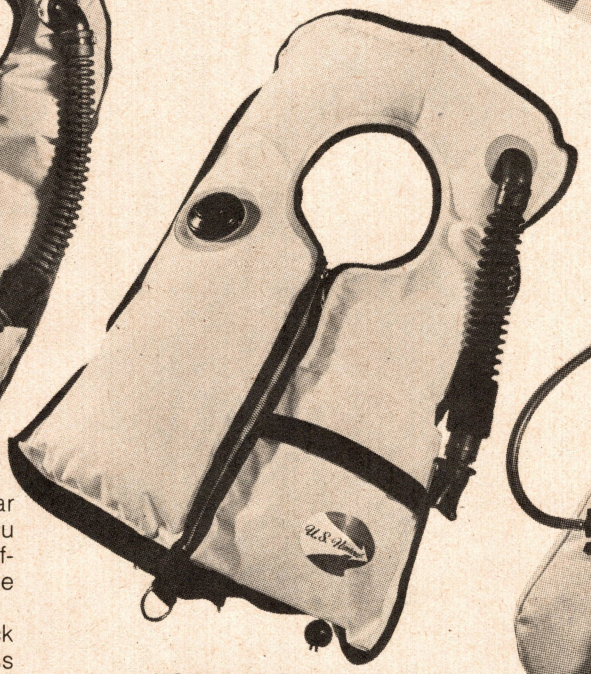
BC roundup



U.S. Nemrod, Push-Lift-S, 6728



U.S. Nemrod, BC26, 6726



U.S. Nemrod, BC24, 6724



U.S. Divers, BC700-705, 7700-7705

feel that they should not be located near the top, or neck, of the vest because you want your compensator to give you sufficient assistance and support on the surface.

In the April, 1976 SKIN DIVER Jack McKenney commented that, "harness straps and snaps are almost as varied as the BC's," and that holds true today. Most safety vests utilize a single waist strap, while the BC's employ several combinations of waist, crotch, and upper body straps. The strap system you choose is a matter of personal preference, but you should be able to adjust your compensator so that it will not ride up around your neck. The straps should not be so thin that positive buoyancy will cause them to dig into your suit or skin, and you should be able to adjust buckles and clips to avoid the same problem.

Many top of the line horsecollar compensators have some type of front pocket. These are held shut by a zipper or Velcro. These are excellent places to carry small lights, fish bait, decompression meters, and slates.

Many horsecollar BC's come with accessory hooks, D-rings, Velcro hose guides, and Velcro accessory loops. Anything from safe plugs to Pelican floats can be easily attached, removed, and refastened to the loops underwater. Hose guides can also be helpful— they make pressure gauges and consoles easy to find.

A quick look at the colors in which BC's can be found tells you that compensator manufacturers are in tune with the color and design revolutions that have occurred in the sport diving field in recent years. Colors can really add a touch of magic to a photograph; and, the contrasting, highly visible colors are easily seen on the surface.

A number of BC's come equipped with whistles and/or CO_2 detonating mechanisms and cartridges. The cartridges come in several sizes, with 12, 16, 25, 26 and 38 grams being the most common. Most dive shops carry ample supplies, and if you fire the cartridge once it must be replaced as it cannot be refilled. Some newer BC's use non-corrosive, Cycolac plastic in the detonating mechanism and some styles employ stainless steel fittings. Although it may seem self-evident, do not ever breathe from a BC filled with CO_2.

I cannot create hard and fast rules that will enable you to decide which style of compensator is best for you and your needs. As a rule, horsecollar BC's are less expensive than wraparound BC's and close in cost to back-mounted units. Many wreck and cave divers are especially fond of the horsecollar style claiming that they are less likely to get hung up or restrict their movement.

The evolution of compensators has not stopped with the invention of the horsecollar style. Many divers use back-mounted units and wraparound compensators. Which style is best for you? You can learn about back-mounted and wraparound BC's in November's SKIN DIVER.

New Gear



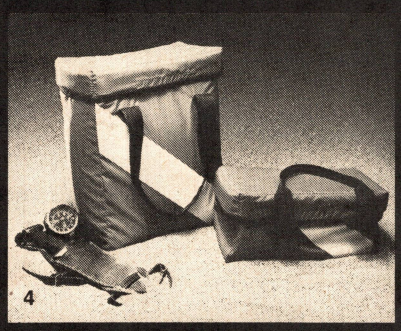
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1 Tekna-Strap—Designed with a brushed stainless steel automatic tensioning buckle in three-fourths and one inch widths. The buckle is spring loaded to expand and contract, perfect for your watch or depth gauge. Retails for $4.95. From Tekna, 3549 Haven Avenue, Unit E, Menlo Park, California 94025.

2 Manta Ray Sport Submersible—An ambient pressure submersible. Divers kneel two abreast with their heads and shoulders dry in an air pocket trapped within the upper hull. Twin thrusters provide maneuverability at speeds to four knots. $6,450. Argus Leisurecraft, 12041 228th St., Maple Ridge, BC, Can V2X 6M2.


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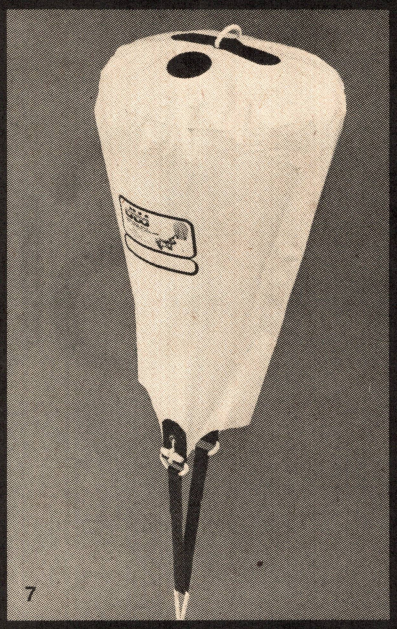

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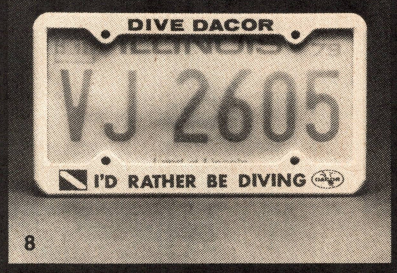
3 Universal Stabilizing Jacket — The jacket slips onto all standard single or twin tank backpacks, and requires no special tools or modification. The center belt loop ensures a snug fit. The jacket will provide unequalled stability, regardless of the depth of your dive. Available at your local Scubapro dealer.

4 Super Cooler—Amazing lightweight, durable, foldable thermal cooler. Double nylon handles, bright red and white dive flag colors. Perfect for that first cup of coffee before a dive, an apres dive picnic, or for loose dive gear storage. $19.95 from Superior Designs, 1100 South Main St., Lombard, IL 60148.

5 Vulcanized Dura Boot — This may be the last boot you will ever need. The heavy rubber sole is vulcanized to its body, which results in an extremely durable boot that comfortably protects your feet. Available in small, medium or large, the innovative vulcanized dura boot will retail for $43.95 from U.S. Divers.

6 Richard Ellis Note Cards—Five by seven inch color note cards. Color separations made from the original paintings, Kromekote paper with white envelope. Six designs, $7.50 per box of ten cards, single or assorted designs, or 75¢ per card, $1.25 postage & handling. Aquatique, 132 Clement St., San Francisco, CA.


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7 Lift Bag for Sport Divers—Called the SPDI, the bag provides a maximum lift of 70 lbs., is made of lightweight, reinforced PVC, and folds down to ten inches long by three inches in diameter. Priced at $63, the bag is available from James E. Mann, J.W. Automarine Ltd., Old Road Lane, Mt. Kisco, NY 10549.

8 License Plate Holder—An attractive license plate holder for your automobile, motor home or trailer. Made of durable, injection molded ABS plastic, the holder will not break, crack, fade or warp in any kind of weather. White with red lettering, the holder fits any standard license plate. $3 from Dacor.

9 Luggage Tag—Engraved, laminated plastic luggage tag. Unbreakable vinyl strap and three lines of machine engraved lettering provide permanent identification. Three inches long, one and one-half inch high. Set of three tags; black, red or blue, $15. Ruche Co., 2201 Ridgeway Dr., SE, Cedar Rapids, IA 52403.

IKELITE'S Substrobe 150



A submersible strobe with a multitude of features

Text and Photography by Geri Murphy

Ikelite, the world's largest manufacturer of underwater camera and strobe housings, recently introduced a new underwater strobe. A self-contained amphibious flash unit, the new Substrobe 150 is a radical departure from Ikelite's long-standing philosophy of building inexpensive housings for topside strobes. And, Ikelite is now the third U.S. company to produce a large, heavy-duty, wide-angle strobe for U/W photography.

The Substrobe 150 features: three variable power modes; a wide-angle port dome; a built-in modeling light; sync/slave capability; a six foot connector cord; and removable ni-cad batteries which can be recharged quickly. While there are strobes on the market that have one or two of these features, the Substrobe 150 is a unique combination that will meet just about any lighting situation.

EXTERNAL DESIGN

The casing of the Substrobe 150 is made of a high impact plastic which is not only impervious to saltwater corrosion, but also extremely resistant to knocks and scrapes. The unit measures five and one-fourth inches in diameter by ten and one-fourth inches long, and weighs eight pounds, three ounces in air. Underwater it is about eight ounces negative (without the arm). The front of the strobe is fitted with a large aluminum ring which helps protect the front port from scrapes or scratches. The strobe head contains a wide-angle flash reflector and dome port to compensate for refraction. The dome is made of an acrylic which helps to distribute the light evenly with a wide-angle of coverage. The Substrobe 150 will work well with just about all wide-angle underwater lenses, including the Nikonos 15mm.

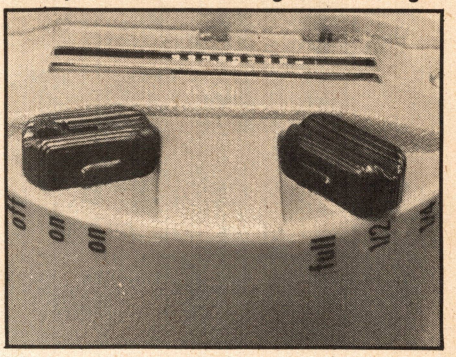
The strobe case separates into two sections approximately two and one-half inches from the front port. These are sealed by a large O-ring gasket, firmly seated in a circular groove. The two sections are held securely in place by two heavy-duty, stainless steel, spring loaded clamps. The clamps are attached to a metal band that encircles the casing and latches onto corresponding hooks on the front of the strobe. Not only does this eliminate the necessity of inserting screws into the housing to attach the clamps, but it eliminates the stress of closing tension when the snap locks are secured.

There are two recessed operating controls located at the back of the strobe, one is the On/Off switch, and the other is the Power Selector switch. The On/Off switch has two *on* positions. One turns the strobe on; the other turns the modeling light on in conjunction with the strobe. There is a safety lock for the *off* position which is extremely useful when traveling. It prevents the strobe from being accidentally switched on during transit. The Power Selector switch offers a choice of three different settings: full (150 watt/seconds), one-half (75 watt/seconds), and one-quarter (40 watt/seconds). The number of flashes and recycle times vary with the three power settings. At the highest power mode (full), the strobe will produce approximately 150 flashes (enough for four rolls of 36 exposure film) with a recycle time of six seconds. Set at one-half power, the strobe will deliver approximately 300 flashes with a three second recycle time. One-quarter power will yield up to 600 flashes with a one and one-half second recycle time.

Located on the underside of the front portion of the housing is a plexiglass bulkhead which contains: the sync cord; the slave/sync switch; and the ready light. When the switch is in the sync mode, the strobe can be fired by triggering the camera shutter. In the slave mode, the strobe can be fired by either tripping the camera shutter or from the light of another flash unit. This is the only large strobe made in the U.S. with this unique capability. The slave sensor is positioned in the flash reflector dish and is omni-directional within the 90 degree field-of-illumination.

The Substrobe 150 is available with either a standard Ikelite connector (SST) or an EO connector. The strobe sync connector is permanently mounted with a six foot coil cord.

Two recessed switches at the rear of the strobe control the strobe's power output and the standard daytime strobe mode or nighttime focus light.





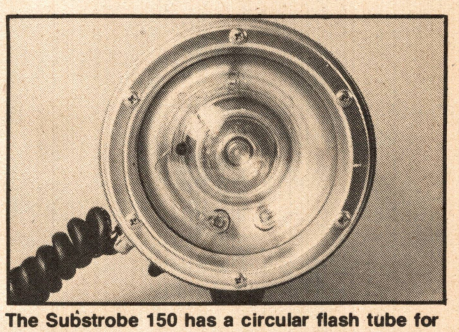
The Substrobe 150 is the only American made wide-angle strobe with a removable and rechargeable ni-cad battery pack. A special Ikelite Quick-Charger will recharge the batteries in three hours.

INTERNAL DESIGN

Located inside the Substrobe's main body is a heavy-duty power pack with six rechargeable ni-cad batteries. The batteries can be charged either inside or outside of the strobe. These batteries are the industrial grade equivalent of a Super D battery, capable of either a slow or rapid recharge, and have an extremely long life for a ni-cad.

When charging, the strobe should be turned to the *off* position and the charging cord inserted into the charging socket of the battery module. When properly plugged into an electrical outlet a small red light located on the battery pack will glow indicating that the batteries are accepting the charge. Because the batteries can be easily removed from the strobe for charging, you can use a second battery pack while the first is recharging. Extra power packs are available for $125.

There are three different battery charg-



The Substrobe 150 has a circular flash tube for even lighting, and a central focus lamp for night photography. The strobe permits either standard camera synchronization or remote slave triggering.



ers available for the Substrobe 150. The Standard Charger ($14.95) will recharge the batteries in 12 to 15 hours, at a slow rate of 400 milliamps. A switch on the back of the charger allows it to be used with either a 120 volt or 240 volt power supply. The special Quick-Charger ($29.95) is a 110 volt charger that will fast charge the battery pack in three hours at a rate of one full amp. Also available is a 12 volt Auto Charger ($9.95) that will charge the unit in 15 hours. Because of the variety of charger options, the Substrobe 150 does not come with a charger included, it must be ordered separately.

The Substrobe 150 carries a special focus or modeling light, located in the center of the flash tube. An invaluable tool for night dives and low light conditions, the focus light aims and illuminates the subject precisely where the strobe light will flash. This light uses only the power equivalent of 15 flashes if left on continuously for an hour. The bulb is in the center of the front half of the strobe and easily replaced. The focus light is supplied with a PR 20 flashlight bulb which will provide a 15 degree beam angle for approximately 100 hours. Brighter bulbs, with a shorter life span, may be used.

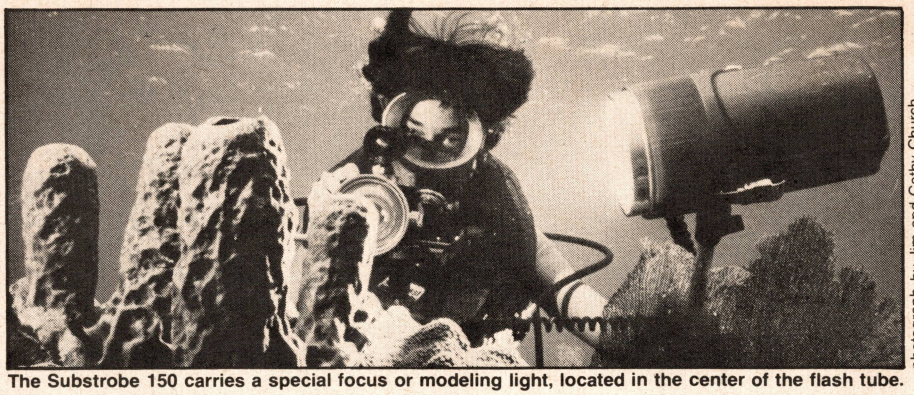
MOUNTING SYSTEM

Ikelite has designed and built a special quick-disconnect flash arm as an option for the Substrobe 150. In fact, there are two versions of this arm which offer some choice to the photographer. The Quick-Handle I ($99.95) is a 22 inch extension arm featuring a special ball socket adjustment with a large locking lever. The ball socket offers an infinite number of positioning angles for the flash arm. The Quick-Handle II ($69.95) is the same length and style, but with the ball socket adjustment. It has a rotating index socket which can be locked into place every 22 and one-half degrees. Both arms are considered strobe accessories and are sold separately. In addition to the arm, there is a stainless steel tray ($9.95) for use with Nikonos cameras.

PERFORMANCE

For open water tests, SKIN DIVER Magazine took the Substrobe 150 to the Bahamas for a week of testing and evaluation. Here's what we found.

The recyling time and flash output of the Substrobe 150 is just as the manufacturer states. In fact, the performance claims were a bit conservative. For example, Ikelite claims the strobe has a 90 degree area of coverage, but we found it to be more. The strobe worked very well with a Nikonos 15mm lens, which has a coverage of 94 degrees. In checking with the manufacturer we found that 90 degrees is the point at which the outer edge fall-off of light has reached one-half an f stop below the light output at the center.



photograph by Jim and Cathy Church

The Substrobe 150 carries a special focus or modeling light, located in the center of the flash tube.

Most strobe manufacturers consider their established angle-of-coverage to be at one full f stop. The manufacturer admits that the Substrobe 150 will cover a 100 degree area without more than one f stop of fall-off on the outer edge. This is an acceptable limit for the average underwater photographer. Most of the testing conducted by Ikelite was done with a housed Canon SLR and 17mm lens (100 degrees).

SKIN DIVER's test revealed that the Substrobe 150 produces exceptionally even lighting because of the circular flash tube. The light output was consistent and the color balance excellent. It is a perfect match for Kodak Ektachrome and Kodachrome daylight films. The color temperature is approximately 5800 Kelvin degrees and provides warm flesh tones and rich colors. Using a Minolta flash meter in a housing, set for ASA 64 film, we tested the light output for each of the power modes. Distance was three apparent feet from the strobe head to the flash meter. At full power the meter registered f8, at one-half power it registered f5.6, and at one-quarter power it registered f4. This test established that the surface guide numbers claimed by the manufacturer are within reason when computed for underwater shooting.

If there are any disadvantages to the Substrobe 150 we would have to say they are bulk and weight. It is significantly heavier than several other models in this class of strobe, but still manageable. The weight and size of the Substrobe 150 is one of the trade-offs for the many features offered. The manufacturer is still working on ways to lighten the strobe, so that it will eventually be neutrally buoyant underwater.

We found the Quick-Charger to be extremely helpful as it reduced the charging time to only three hours. However, the batteries did become hot to the touch during charging. The manufacturer claims the batteries will get warm, but the user need not be alarmed. A special thermostat has been installed in the battery charging circuitry and it will switch off if the battery temperature exceeds 130 degrees. With this particular charger, when the batteries are fully charged the light will go out and the charger will automatically switch to a trickle charge. This protects against over-charging.

We found the flush level power switches on the rear of the strobe to be a little difficult to operate, especially with gloves. However, these recessed switches are less likely to break because of their low profile design. With a little practice, one becomes adept at operating them.

We found the ready light to be a little difficult to see in bright ambient light conditions because it is slightly obscured by the sync/slave switch. However, there is a distinct, audible whine heard while the strobe is recycling. When the strobe reaches full power, the high pitched whine stops and the ready light goes on. The photographer does not have to take his eyes off his subject to see if the strobe has recycled; he can hear it.

PRICING

The results of SKIN DIVER's tests show the Ikelite Substrobe 150 to be an excellent value for the money. While it does not have the brightest light output of the big strobe category, it does have even illumination with no hot spot, is rugged and offers many more features than any other single strobe on the market. The cost of the Substrobe 150 varies depending on which features you select. The base price, with an Ikelite connector (SST), is $495. The strobe is available with an optional EO connector for $574, which is still competitively priced with other multi-powered, wide-angle underwater strobes. In addition to the strobe, one must consider purchasing a battery charger ($15 to $30), a flash arm ($70 to $100), and a flash arm tray if using a Nikonos ($10). The total investment will run somewhere between $590 and $700. An extra battery pack ($125) is also a consideration.

In a product field so well covered by other manufacturers, it is hard to imagine how another strobe could be different. Yet, Ikelite has brought to the market a strobe with every standard feature; plus a few new ones. For information see your local Ikelite dealer, or write: Ikelite U/W Systems, 3303 North Illinois St., Indianapolis, IN 46208.

SDM travel SECTION



PANAMA'S FABLED SAN BLAS ISLANDS

By Vesta Rea-Salisbury

Photographs by Dennis Salisbury





Heat waves rise like steam from a kettle on the coral airstrip, Rio Sidra, on the eastern coast of Panama. "Well, it's remote," comments one of the air taxi's four passengers. There is no disagreement from me.

Parallel to the runway is a fishing dock where several *cayucos* — long, dugout canoes with no centerboard and little keel — lie in wait for the arriving passengers and their luggage. With studied indifference, the Cuna Indians quietly remove objects from the passengers' hands and walk back to load the *cayuco*. At first I did not notice the Indians' size, but then a strange sensation — such as Gulliver must have felt among the Lilliputians — overwhelms me; I tower over the Cunas by several inches, and I am only five foot five.

"Are all the people this short?" I ask the pilot.

"All the ones I've ever seen are; however, I've never been any further than this hacked-out piece of jungle in the middle of nowhere. Ask Tom Moody. He knows everything there is to know about these Indians."

The *cayuco* leaves the dock and shoots through the water like a shark in pursuit of prey. The Cuna steers the sturdy craft with the same skill of his ancestors some 300 years before. The six mile trip to Pidertupo Village (*pider*, meaning black bean; *tupo*, meaning island) is quick and uneventful.

Pidertupo, an island located at the northwest end of the Comarca de San Blas, is two and one-half sandy acres of heavily laden coconut palms and marvelous beaches. Dotting the neat, clean landscape are seven white cane cottages *(bohios)*, a splendid dining house and bar, a windmill, a water tower, and a modern sewage system. Save for these unique conveniences, Pidertupo appears much like its sister islands that have been in the Cuna reserve for hundreds of years. Its chief architect, Tom Moody, has made a paradise out of the remote wilderness.

Tom Moody's blue eyes peer out toward the *cayuco* as it approaches the island dock. He stands bare-chested and tanned; his cut-offs are clean, but old; his hands cut and bruised from the labors put forth to create comfort for his visitors. His belly rolls casually over the waistband of his pants. His round, fortyish face with its deep, sun-etched lines, wears a warm, genuine smile. "Welcome to Pidertupo," he begins. "We will take you to your cottages where I am sure you will be very comfortable." He doesn't sound like a hotel manager, but more like a host welcoming you into his home. "You'll find we only have facilities for 14, making all who come one big happy family."

A Cuna reaches down to take my luggage, and as he walks away, his small size once again strikes me.

"Are they all so small?" I queried Tom.

"Yes, and even smaller," he begins. "They are among the shortest people in the world. Men average four feet eight inches while the women seldom get above four feet five. You will find when we go into the villages that the children will run up and compare themselves to you. They seem to be awed by us taller beings."

"Also, while I am on the subject of my neighbors, let me give you a warning. When we visit the villages, see to it that you wear long pants and a shirt or a dress — no shorts, bathing suits or halters, for these violate their code of morality and modesty. Because of the people's strong moral upbringing, they frown upon exhibitionism in any form. Parading around in abbreviated string bikinis, and topless or

United States Virgin Islands



Photo: Bret Gilliam, V.I. Divers, Ltd.

Beyond the blue horizon.

Diving by day, place-hopping by night. And well-organized dive centers on all 3 islands. Write directly to those listed for details in their area. For a copy of our 28-page Dive Guide to the Virgin Islands, write to the Division of Tourism at the address below.

St. Croix:

Above & Below, 12 Strand Street, Frederiksted 00840. Tel.: (809) 772-3701

Caribbean Sea Adventures, Kings Wharf, Christiansted 00820. Tel.: (809) 773-6011

North Star Dive Tours, Box 3461, Christiansted 00820. Tel.: (809) 778-2125

Pressure Ltd., Box 3612, Christiansted 00820. Tel.: (809)77-DIVER

Salty Dogs Inc., 59 Kings Wharf, Christiansted 00820. Tel.: (809) 773-2678

V.I. Divers, Ltd., PanAm Pavilion, Christiansted 00820. Tel.: (809) 773-6045

St. John: (Zip Code 00830)

Scuba Ventures, Caneel Bay Plantation, Tel.: (809) 776-6111

St. John Watersports, Box 70, Cruz Bay, Tel.: (809) 776-6256

St. Thomas: (Zip Code 00801)

Aqua Action Inc., Wintberg Peak, Tel.: (809) 775-3275

Bolongo Bay Beach & Dive Club, Box 3381, Tel.: (809) 775-1800

Caribbean Divers, Red Hook, Tel.: (809) 775-1935

Ocean Adventures at Bolongo Bay, Box 7337, Tel.: (809) 775-2710

St. Thomas Diving Club, Box 4976, Tel.: (809) 774-1376

Virgin Islands Diving School, Box 9707, Tel.: (809) 774-8687

Joe Vogel Diving Company, Box 7322, Tel.: (809) 774-2321

Watersports Center, Box 2432, Tel.: (809) 775-0755

United States Virgin Islands
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SAN BLAS ISLANDS

nude bathing are very offensive to the Cuna."

Diving at Pidertupo is different — primarily because of the clientele to which it caters, not to mention the island's far-out location in the Caribbean. Since the operation is small, there are no regimented groups arriving. Those who come here come individually through word-of-mouth advertisement. The resort has not been commercialized as a dive mecca — although it could pass for one.

The Moody's pride themselves on running a sophisticated resort for the well-traveled, intellectual guest. They wish to open their hospitality to enough people so that they can afford to live on their island, but they have no grandiose ideas of becoming rich. Dive equipment is there for the guest who wishes to enjoy the activity, but the sport is treated on the same level as any other sport you might participate in.

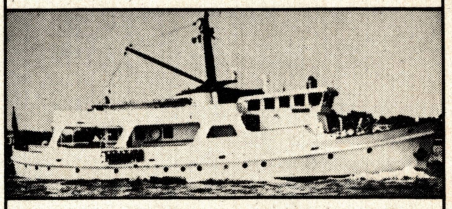
As for the sea, that also is unique. The island sits in the back waters of the Caribbean. There is an extremely high degree of salinity owing to evaporation from the hot tropical sun in the relatively shallow water (less than 200 feet). It is a more tranquil Caribbean with no appreciable ocean current. The most outstanding feature of the area is the millions of curious fish (all sizes) that swim up to you without hesitation. You are the stranger in their untainted environment, and they are unquiveringly tame and inquisitive.

Sometimes this tameness can become unnerving. The barracudas, not noted for respecting a diver's privacy, become constant buddies in the San Blas. They will lazily stalk you like puppies, swim up to your mask and give the famous 'cuda yawn' (allowing you the privilege of counting each and every one of their pointed teeth) and then change colors and become part of the habitat.

On the other hand, a spotted eagle ray may mimic your movements like a synchronized swimmer. While lobstering around a coral head, I found myself in the company of one of these magnificent butterflies of the sea. His six foot wingspan stirred the water above me, and as I looked up, the dog-faced head was inspecting my person. I moved out over a sand flat and he tagged along. The 12 foot barbed tail looked like a streamer on a kite, and the wings feathered through the water like a rolling wave. He played like a child, always careful not to get close enough to be touched. After several minutes he became disinterested in this strange person intruding in his environment and glided quietly away.

There are several interesting phenomena of the area, all directly or indirectly related to the extremely high plankton population allowing the living organisms

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to feast on the nutrients carried into the sea from rich jungle rivers. This plankton makes the water cloudy, and while we were there in September, we found visibility to vary between 80-100 feet.

With the combination of plankton, high salinity, no current and warm water, a near optimum condition is created for coral colonies.

When was the last time you found, in 30 feet of water, forests of black coral? If ever, I can bet it has not been often, but in the San Blas it is there for the enjoying. Black coral is abundant at nearly any depth. Knowledgeable biologists have the theory that this particular type of growth requires shade for best development. The forests are virgin — primarily because there has been no commercial harvests and few visiting divers to interfere with growth. It is a paradise for those of us turned on by diving though the feathery limbs of precious coral trees.

If, on the other hand, you are one who enjoys diving but wants a little more variety than being isolated on two and one-half acres of Pidertupo, fear not — you will not come down with island fever. Actually there is so much to do and see while visiting this area, a week is hardly enough time. Just paddling around from one Indian village to the next could offer months of interesting outings.

There are 30,000 Indians in the Panama San Blas area; however, they live on only ten of several hundred islands. The occupied cays are the ones closest to the mainland, making it convenient for the agricultural tribe to go to their inland farming plots. The out islands, although unoccupied, are also owned by the Cunas and grow their big cash crop — coconuts. Any camper with ideas of setting up temporary residence on one of these uninhabited cays should reconsider — you would be trespassing and quickly removed.

With so many Cunas on so few islands (as many as 1000 or more per isle), one would think there would be constant upheaval. This is not the case. The inhabited islands do have crowded housing, but they have tightly-knit families, extremely low crime rates, clean conditions and a happy attitude.

The head of the Cuna household is the eldest male, but women have somewhat equal privileges and authority in the Cuna society. The eldest woman does the trading and manages most of the household. When a man marries, he lives with his wife and is subservient to her family. If he chooses to divorce, he simply takes his things and moves out, leaving the woman and his children behind. Cunas are always more excited about having daughters than sons, with the anticipation of future sons-in-laws to help with the chores.

The Cunas are believed to be the last of the full-blooded Carib strain, that blood-thirsty group that ravaged the Caribbean before and after the Spanish conquest. These Panama Indians did not always live in the San Blas islands, but migrated throughout the centuries from the Pacific side of the isthmus to the Atlantic side. They strived for a perfect bloodline, but in the 1700's French Huguenots started intermarrying with them. This could not be tolerated, and by 1757 the Indians had killed off the French. The Indians, although small, are ferocious fighters and were unconquerable by all adversaries. Because of their stubbornness and determination to hold onto their heritage, their culture still remains as it was hundreds of years ago, and for the visiting diver this is especially rewarding.

Part of this culture is the *mola* — an embroidered blouse finished in a reversed applique technique. Traditionally, the design is abstract and often based on the pattern of the brain coral and the life of the sea. The origin of the *mola* is unknown, however, they first appeared during the Spanish colonization. It is thought that they are the residual of pre-Hispanic body painting designs. When the tourists come into the villages, they are besieged by the native women trying to sell their

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molas from 20¢ to $20. The barter system is highly acceptable here. This colorful art is worth buying, for in the U.S., framed *molas* can run as much as $150.

When one is ready to leave off sightseeing and return to the water, a different type of dive is in store for you. Tom Moody and a Cuna guide will take you deep into the interior of the mainland and let you snorkel down the fast jungle rivers. Although the water is tinted brown from tannic acid leaching out from the rich humus soil, visibility is excellent. Tumbling waterfalls cascade down sheer cliffs and hanging vines, and bird of paradise plants blend into the topography. Tranquility and solitude add yet another dimension to underwater exploration.

The days fly by — each bringing new excitement and discoveries into the past. After a long day of many activities, you might leave your *bohio* and stroll quietly along Pidertupo's deserted beaches. The sun dips low and reflections of weird shadows create mystery and wonder. The eye follows the gentle surf that slips deep into the sands of the San Blas, and the diver relives his experiences in memory and knows he must return.

PANAMA TRIP TIPS

Air Service to Panama City: Pan American, Lan Chile, Lloyd Aereo Boliviano, Taca International, Air Panama, Braniff.

Air Taxi Service from Panama City to Rio Sidra Airstrip: Servicios Aereos, S. A. (S.A.S.A.).

Palmera; located on the island of Aligandi near Columbia and run by a Cuna cooperative; four rooms, cement building; sometimes open; sometimes not.

Hotel Porvenir; located in the heart of the tourist area and serviced by Porvenir Airstrip; capacity for 30 guests.

Hotel Anai; located on the island of Wichubula (pronounced Witch-ub-wall-ah); operated by the Cunas on this village island; capacity unlimited as they just string up another hammock.

Hotel San Blas; located on a village island near Porvenir; consists of one or two large communal houses where hammocks are strung or sleeping bags laid down; strictly for campers, so bring food and equipment.

Moody's Pidertupo Village; located on Pidertupo Island; capacity, 14 people — double occupancy; operated by an American couple; scuba diving facilities. Closed May and November. Address: Apartado 6-4092 El Dorado, Panama City, Panama.



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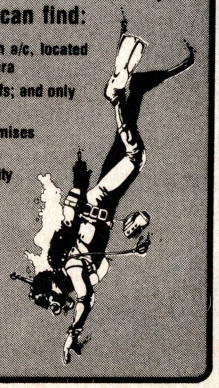
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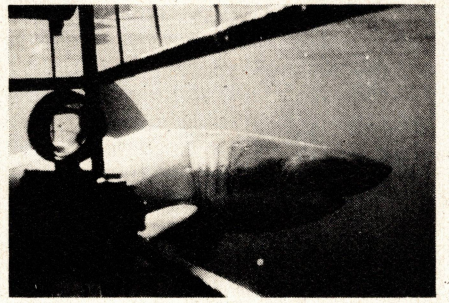
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See & Sea Travel's 1981 great white shark expedition will depart January 23 for eight days. The expedition to South Australia is limited to four participants



using two, two-man shark cages. Past adventurers have enjoyed encounters with up to nine sharks of 11 to 15 foot lengths.

SAN SALVADOR MEDICAL PROGRAM

The second annual Diving Medicine in Depth (DMD) instructor program will be held November 8-15, on San Salvador Island, Bahamas by Human Underwater Biology, Inc. (HUB). The program is designed to give instructors more appreciation for the complexities of dive medicine and physiology.

Early registrations are recommended as space is limited. For program brochure and information contact: Program Coordinator, Dept. 1250, Human Underwater Biology, P.O. Box 5893, San Antonio, TX 78201.

KILBRIDE/COUSTEAU FILM

Bert Kilbride, owner of Kilbride's Underwater Tours, recently completed a film for TV titled *People of the Sea*. The film is about Jean-Michel Cousteau's dive experiences with Kilbride, and will be distributed internationally. For information about Underwater Tours, write: Saba Rock, Box 40, Virgin Gorda, British Virgin Islands.

SCUBA TOBAGO

New, all-inclusive 8 day/7 night Scuba Tobago package tours to the island of Tobago are being offered through December 15. Priced at $529 per person, double, the package includes accommodations at the Crown Reef Hotel; round trip airport transfers; breakfast and dinner daily; welcome cocktail; two boat dives daily (includes boat, air, guide, use of tanks and weights — 12 dives on 8 day program); unlimited air fills, and more. Single supplement is $79. Non-divers package is $369. Air transportation is additional. For information contact Weekends Away Travel, 6015 Garfield Street, Hollywood, FL 33021.



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CAYMAN PHOTOGRAPHERS

Nancy Sefton and Bonnie Charles, residents of the Cayman Islands, are now working as a team to handle commercial photo assignments both above and below water. Between them, Bonnie and Nancy have completed successful com-



mercial photo assignments for Kimberly-Clark, 20th Century Fox, the Cayman Islands Dept. of Tourism and numerous island businesses, involving topside as well as underwater photography. In addition, they offer overnight processing of color slides and black and white film. Nancy Sefton and Bonnie Charles may be contacted, via Air Mail, at P.O. Box 1200, Grand Cayman, British West Indies.

DIVING DOCTORS

The International Society of Aquatic Medicine (ISAM) will host a dive course for physicians (Category I) at Stella Maris (Bahamas) October 25-November 1, 1980. An Annual Meeting and Diving Symposium (Category I) will be held May 16-23, 1981 at Spanish Bay Reef, Grand Cayman. For details contact: Michael Rosco, M.D. % ISAM, 1127 Wilshire Blvd., Los Angeles, CA 90017.

BONAIRE

Bonaire now offers night tennis, has a new yacht club, two new restaurants, and a completely refurbished disco in addition to its enlarged hotel facilities and its casino. As in the past, however, its undersea gardens will remain primary attractions for tourists.

During much of the last two years flight operations have been limited because of the construction of a new runway. At present, however, the runway again can accommodate the 125 passenger DC-9's of ALM Antillean Airlines. ALM, which now operates several shuttle flights daily between Curacao, Aruba and Bonaire, has just inaugurated the first non-stop scheduled service between Bonaire and the United States leaving Saturdays at 3:00 pm.

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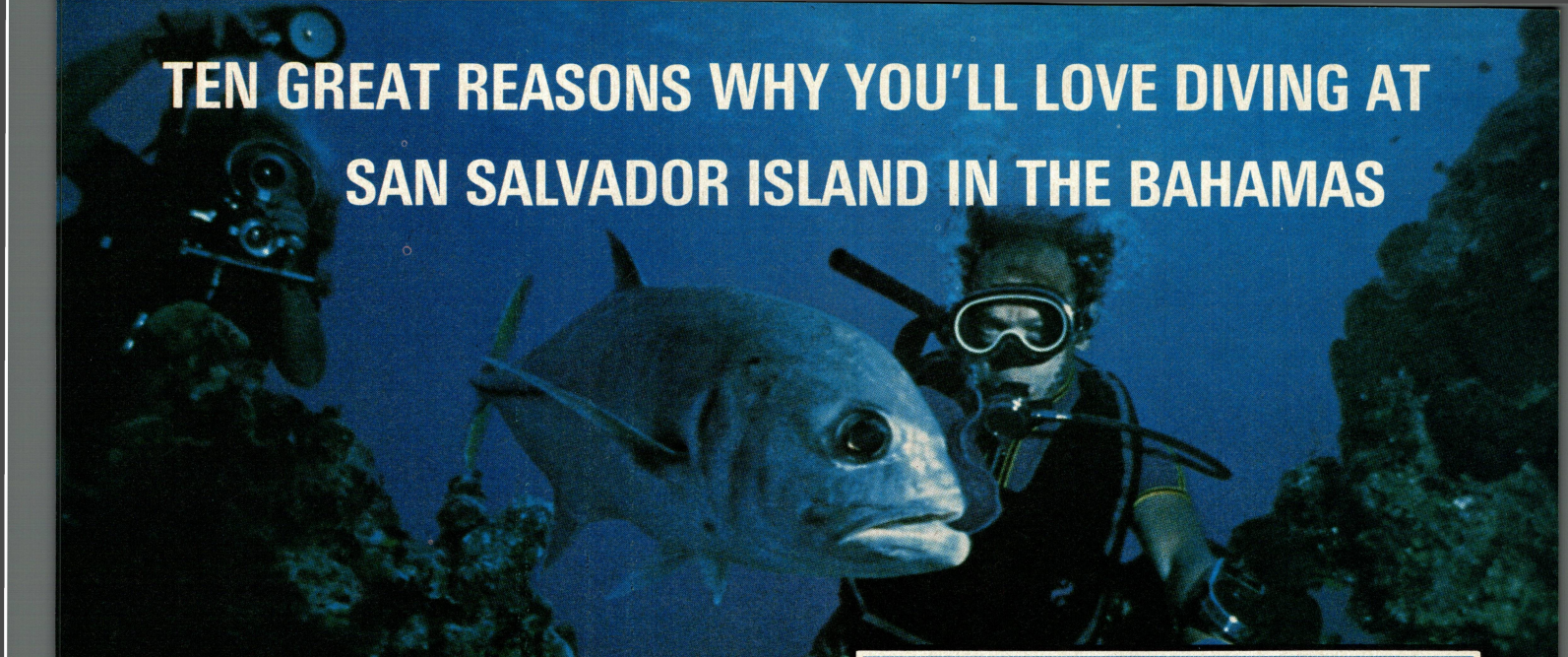
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Weekends Away Travel has scheduled a series of all-inclusive 8 day/7 night scuba Barbados package tours to the island of Barbados, with dives to wrecks and beautiful reefs, through December 15, 1980. Priced at $539 per person, double occupancy, the packages include accommodations at Barbados Beach Club; airport transfers; breakfast and dinner daily; two boat dives daily (includes boat, air, guide, use of tanks, and weights — 12 dives on 8 day program); unlimited air fills; and welcome cocktail. Single supplement is $79. The rate for a non-diver is $379 per person, double. Air transportation is additional.

For information, contact any travel agent or the tour operator, Weekends Away Travel, 6015 Garfield Street, Hollywood, FL 33021.

HORIZON'S END

Horizon's End of Roatan, Honduras, has appointed Alejo Monterosso head divemaster. Mr. Monterosso has ten years of experience in sport and commercial diving in Roatan.

Horizon's End opened in September, 1979. This small, 15 guest resort caters to divers. All dives are tailored to individual and group interests and unlimited diving is offered at no extra cost. For further information contact: Horizon's End, Box 1814, Gretna, LA 70053.



Alejo Monterosso appointed head divemaster at Horizon's End in Roatan, Honduras.

COZUMEL MEDICAL SEMINAR

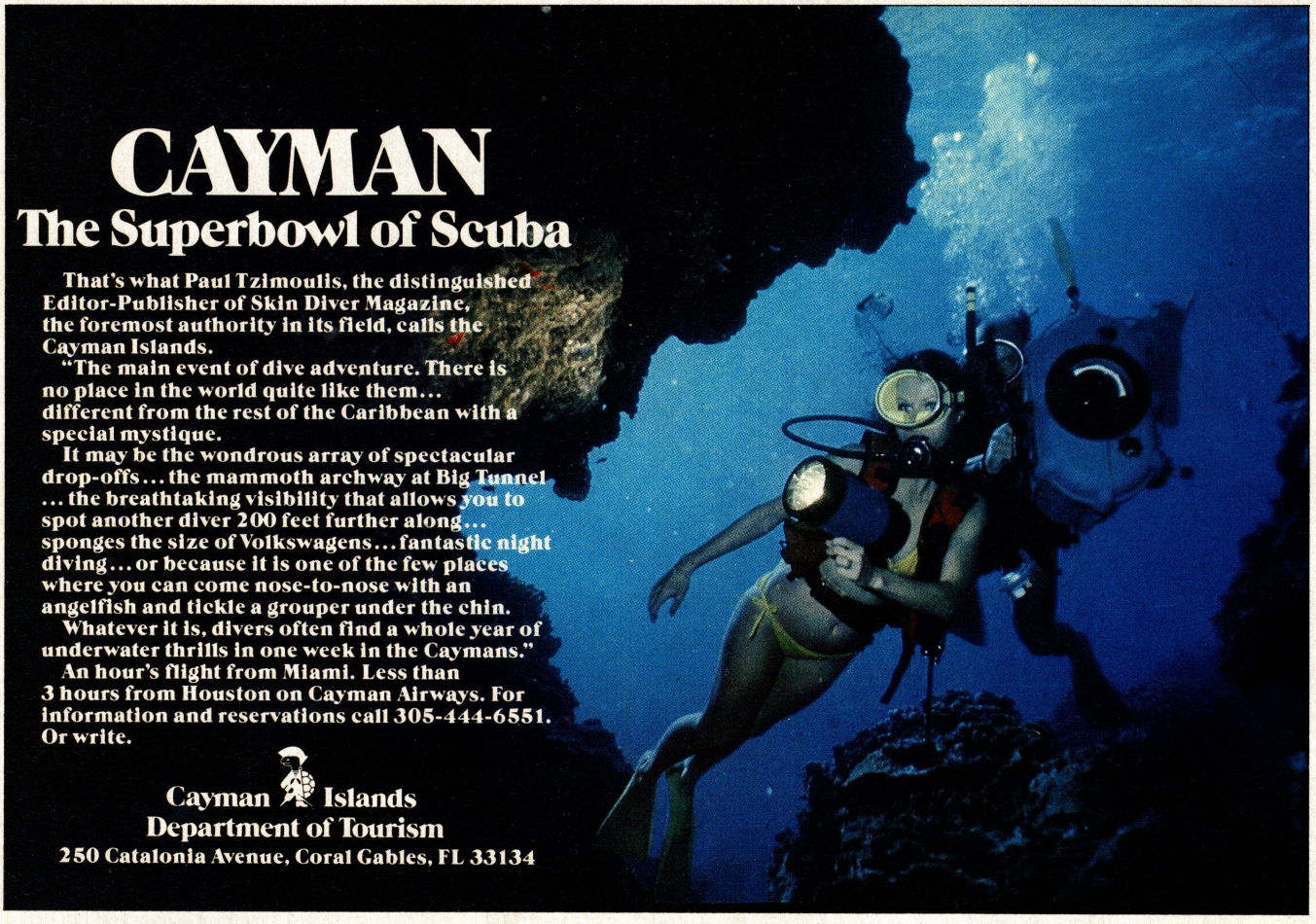
The next Advancing Course on the Medicine of Sport Scuba Diving will be held in Cozumel, Mexico, December 6-13, 1980. It is designed for physicians who dive and/or see divers in their practices.

Meetings will be held at the Mayan Plaza Hotel and a complete dive program is scheduled with Aqua Safari of Cozumel. Meeting coordination and travel arrangements will be by Helen Turcotte of Medical Seminars, Inc. For brochure and academic schedule contact: Jefferson C. Davis, M.D., Hyperbaric Medicine, P.A. Methodist Plaza, 4499 Medical Dr., San Antonio, TX 78229.

U/W MEDICINE

The Underwater Explorers Society of Freeport, Grand Bahama Island will present its tenth annual Underwater Medicine for Physicians course, November 15-22, 1980.

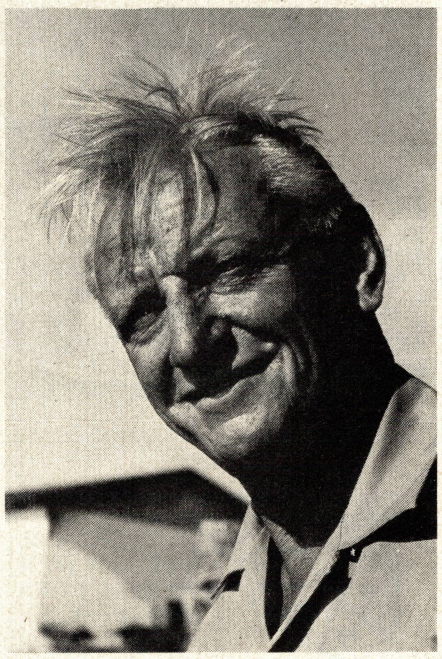
Over 300 physicians have trained at the facility in Freeport. It features an 18 foot deep tank and on-site recompression chamber, as well as a multitude of dive areas immediately offshore. The Dive Medicine Program is approved by the Undersea Medical Society for 25 hours of Category I AMA Credit and features small classes and individual instruction. For information contact: Edward S. Tucker, M.D., Director of Medical Education, Underwater Explorers Society, 64A North Main St., Essex, CT 06426.



ART MCKEE DIES

Art McKee died, the victim of a heart attack, on June 26 in Florida. In his 69 years of life he followed only one discipline, that was to search for treasure, and share the experience with others.

Art did it the hard way. When he began his quest for treasure the hardhat dive suit was safe and available. He never broke the habit, even though climbing around on an old ballast pile with 1925 pounds of armor covering your body is



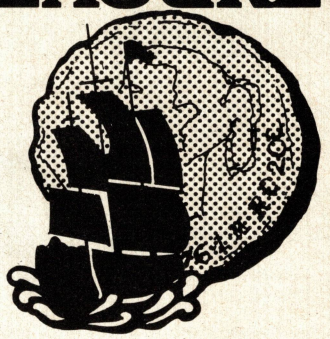
not a modern day salvager's dream. Charlie Brookfield was with Art on his salvage of an old galleon off Gorda Key in the Bahamas. He relates, "Art was hard to steer around the bottom with line signals, and you couldn't pull him because of his heavy dive suit. The water was clear and from the surface we could see these black loaves of bread down near the stern of the ballast pile. The only way we could get him to move down that way was to tap his helmet with a long bamboo fishing pole then point to the artifacts." When Art finally picked up the loaves, they turned out to be 80 pound silver bars.

In later years he teamed up with Ed Link and Mendel Peterson to search for treasure in such remote locations as Pedro Banks and Port Royal. He nearly lost his life on an island off the coast of Venezuela. While searching for an old abandoned fort he lost his way in the forest-filled hills. He survived ten days of heat and exhaustion by eating the pulp of cactus plants.

His most recent successful treasure expedition took place in 1979. He returned from a Caribbean dive site with silver bars and the knowledge that there were a "Great many more where these came from!" That sequel was never to be written because even as he made the arrangements for another salvage expedition, his health began to fail.

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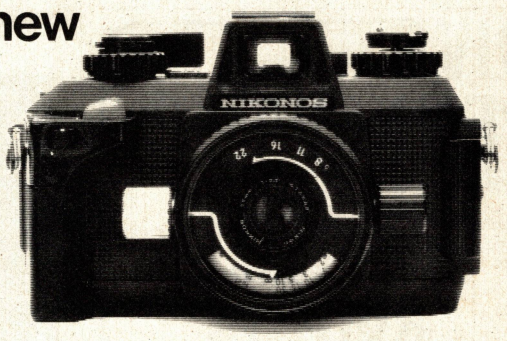
Chinchorro Reef littered with English merchant ships and Spanish Galleons is located on the southeast coast of Yucatan, Mexico. The reef which is 20 miles in diameter has never been fully explored. Now with permission of the Mexican Government you can be one of the first divers among these long forgotten victims of the sea.

Since the Mexican Government has forbidden removing any artifacts found on the reef, you can discover these legends and their cargos disturbed only by the sea.

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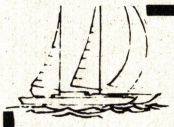


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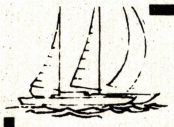
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THE HOTEL GAME: LOCATING AND EXPLORING OLD LANDMARKS

BY JOHN C. FINE

All that remained was a stone hearth and the outline of a foundation where the hotel stood. Local historians remembered its grand era, when wealthy vacationers stayed the weekend and took excursions from the hotel dock aboard a ferry steamer. Even older than the hotel, was the history and legend surrounding the lakefront property where the hotel was built, near the site of an Indian encampment used before the Revolutionary War.

Locating the hotel was fairly simple. Almost everybody in town could give directions, and any fisherman on the lake knew where the ferry pier had been. It's like that just about any place in the world. People who have lived in a small town or village have the landmarks in their heads, and are usually more than willing to give directions.

A universal treasure hunter's guideline would be to search for artifacts where people have congregated. As winter approaches, men and women with metal detectors are seen combing the beaches for coins and rings; relic hunters spend hours researching the history of famous battles, seeking out the ravine or revetment where soldiers fought; archaeologists seek out burial mounds and Indian campgrounds where the remnants of civilization are likely grouped enmasse; and for the treasure hunter with the patience to seek out the site of old hotels — especially those that were built on lakefronts, shorelines or rivers — rewards can be exciting.

No special tools are necessary to extract the finds people left behind 100 or so years ago — just a pair of swim fins, facemask and snorkel. While the land portions of old sites have often been picked over, like as not, the area in shallow water in front of and near these old hotels is virgin territory.

As good an example as any is the weekend I spent at Lake George, New York. Rented outboard and dive gear in hand, I set out to search for a dive site that might yield old relics. The man who rented me the boat pointed across the lake.

"Over there, by that mountain. There was an old hotel there. Might be you'll find something," he said.

All too often directions on the water are like that. "Just over there," or "somewhere in that area," turn out to be a few square miles of ocean or lake that would require a month to explore underwater.

The man who rented me the boat couldn't be much more specific, so I just loaded my gear and set off in the direction he pointed. When I got to where I thought he meant, I pulled into shore and ran close along the bank until I found a summer cottage with a man outside doing some work on his dock.

"Do you know where there was an old hotel in here, someplace along the lake?" I asked him. The man stopped nailing, seeming to welcome the brief interruption from his hot work.

"Are you going scuba diving?" he asked, curiously looking at my gear in the boat.

"Yeah," I answered, friendly.

"My son goes in for that . . ." the man said, and in a few minutes not only gave me excellent directions to the hotel site I had asked about, but called to his son who brought down a map of the lake and a turn-of-the-century tourist guide book with lithographs of the old hotels.

"You can't miss it. Once you pass Turtle Island, keep your eyes open for the rocky wall. You'll come to the old ferry pier first. That was where the hotel was. Nothing left of it, burned down and all grown over now. But you can see where the old ferry landing at French Mountain Point was, just under the surface," the man added as I pushed off.

It was just as he said. A few miles along the shore I passed the island and after another mile or so, I came to the rocks. Letting the boat idle, I paddled in close to shore and sure enough, just under the surface, were the rotted pilings of the ferry dock.

Tying the boat off, I could hardly wait to get into the water. I had just plopped in and ducked my face below the surface in three feet of water when I discovered a hand-blown medicine bottle.

As I swam around the ferry pilings, there were plenty of signs of human activity from over 100 or more years ago. I found a beautiful china cup; the handle and a piece of it was missing, so I left it behind. I picked up a few more hand-blown bottles, one of which dated to the Revolutionary War period. Then, much to my astonishment, 100 or so yards further along, I found the missing piece of the porcelain china cup. I swam back fast to try to locate it. I found it, put the two pieces together underwater, and saw they matched perfectly!

Enthused by my finds, I began searching further down along the bank, near a cove. All of a sudden I came upon what every treasure hunter dreams about finding: a safe. The outline was unmistakable. The safe was open, the door pulled off, and the metal rusted. I reached inside, sticking my hand deep

into the mud that had accumulated in the old safe. While all I found was mud, it surely encouraged the notion that snorkeling or diving in front of an old hotel site can be exciting.

The site of the old ferry boat pier was even more rewarding. The warm summer days must have prompted passengers and fishermen using the pier to drink a lot of beverages, for the lake yielded plenty of hand-blown bottles and remnants of crockery.

At another lake in a resort community about one-half hour from my home, a trip to the village library produced an old map of the town. I checked the map against known landmarks and found it was a simple matter to locate the site of two hotels and an old dock. They were all built in the early 1800's, and none remained standing. A book of local history in the library even produced old lithographs of the hotels in their heyday. Remnants of the dock were easy to find. Stone rubble that had formed the base of the pier supporting the pilings was visible just below the surface. Since the underwater obstructions attracted fish, the spot was popular among local fishermen. The owner of a small marina knew right where it was.

Snorkeling in very shallow water, not more than one or two feet deep, I found an assortment of relics that included an 1804 large cent; a pitcher; crockery with English hallmarks; an assortment of old hand-blown torpedo-shaped bottles, some from as far away as Belfast, Ireland; as well as a plethora of the assorted modern scrap usually associated with diving the shallows.

Apparently, one of the hotels had been vandalized at some point, perhaps when it was closed during the winter, for there were literally hundreds of commercial service plates, cups, dishes and glasses scattered in the lake.

Public parks near the water, where there is a rocky shoreline or jetty from which folks could throw things, are also good bets for underwater exploring. If the site also included a turn-of-the-century bathhouse, or was used as a gathering place for community events, bottle hunters willing to don mask and fins will come away with interesting and sometimes valuable finds.

Probably the most logical way to go about deciding where to look in shallow water is to think like a litterbug. Wherever one might consider tossing an empty bottle, picturing the old hotel when it was open for business, or the old pier chock full of people, is where one ought to look.

In some lakes, as soon as the summer sun begins to promote plant growth, it becomes a little more difficult to locate underwater finds. If one is hearty, or has a wetsuit, toward the end of the winter into spring is the best time to look.

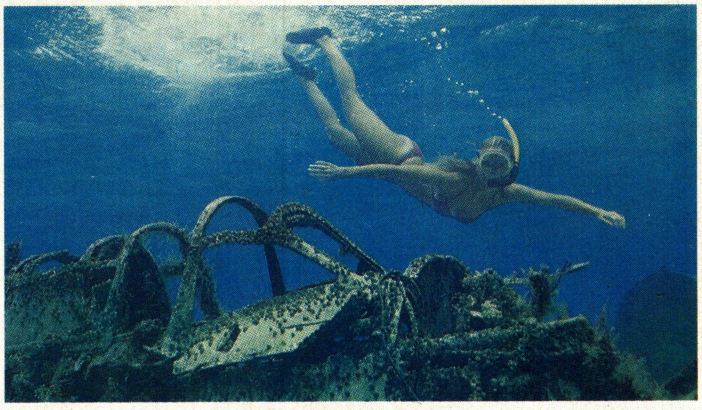
Getting in the water soon after winter storms have turned up the bottom, exposing new artifacts that had been covered by sand, usually leads to finds, even in areas that are heavily dived.

In one lake I used to train classes of scuba divers year after year, going to the same spots, in front of the place an old hotel once stood, the pickings of old bottles and relics became slim. After every winter, however, divers in my class always unearthed new finds.

Learning about local history, the leisure habits of people in resort communities 100 or more years ago, and the folklore surrounding historic lakes, can be almost as much fun as finding the relics that are sure to be there. It can be a rewarding challenge, studying an old map, poking around village archives, talking to a town historian or elder resident. Then, detective work done, seeing it proved out a few minutes after poking one's facemask underwater is a rewarding thrill.

Over the years my dive students have enjoyed the challenge of doing research on a local site near home, then diving and finding artifacts right where they predicted they'd be. Learning, then finding, has sure made some of the artifacts come alive with the imagery of historic places and events. In fact, it's so much fun, we've taken to calling our knee-deep underwater explorations the old hotel game.

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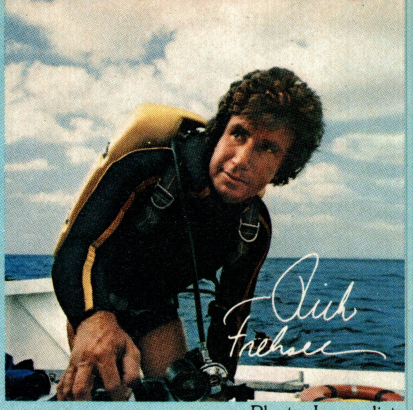


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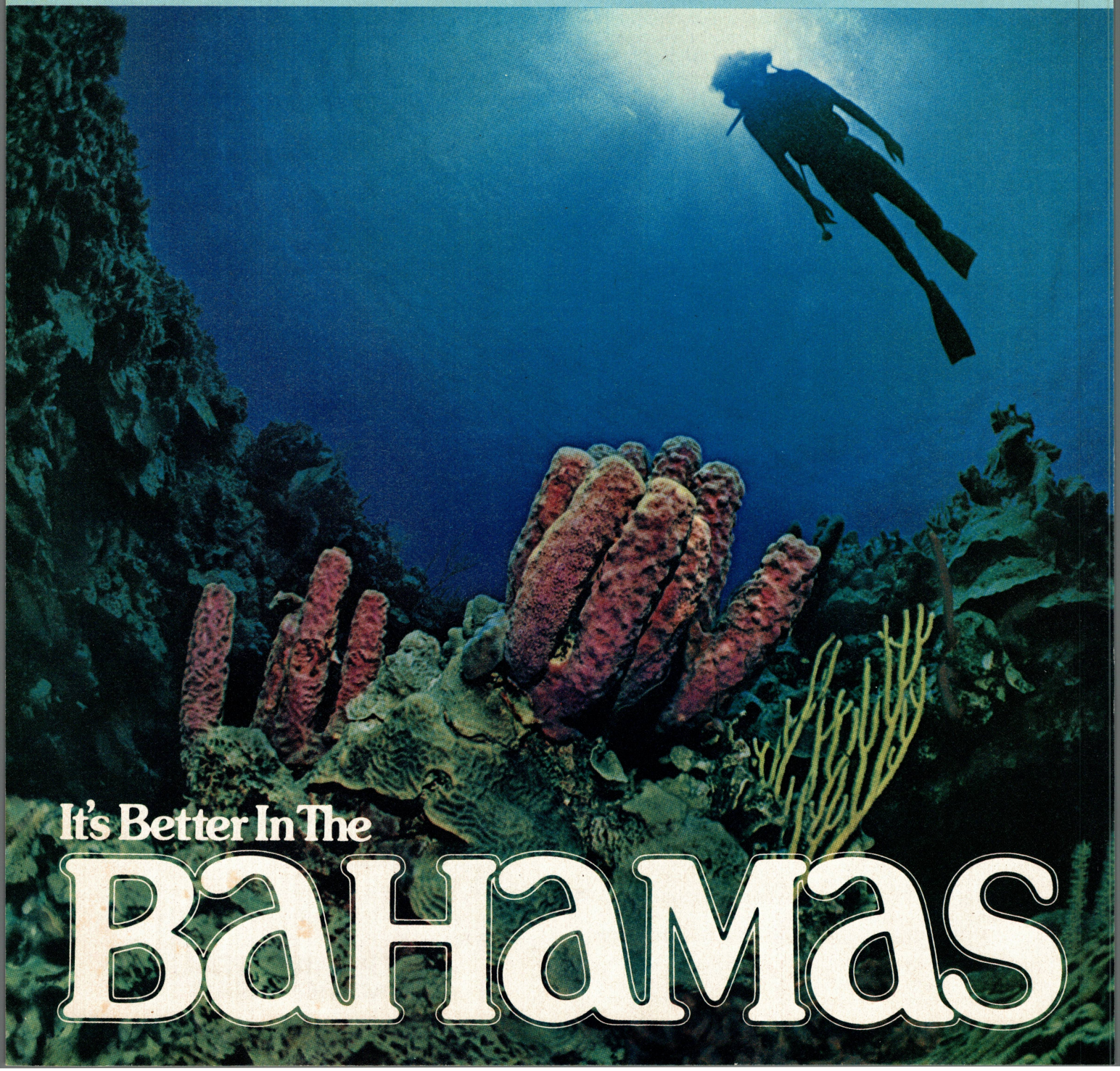
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It's Better In The BAHAMAS

Treasure Fleet

(Continued from Page 29)

that could operate under the extreme salvage conditions.

During the winter hibernation of treasure divers, MacAllaster huddled with an electronic superstar by the name of Lee Harding. Lee's previous encounter with treasure diving was centered around some early work on a 1733 Spanish galleon off the Ragged Keys, south of Miami. He had developed an underwater detector that worked rather well, but not under the conditions of the Ft. Pierce site. Specifications for a more rugged detector were laid out and juggled around to satisfy the most critical parameters. What emerged from the backroom by springtime 1979 was an incredible salvage unit. It was sensitive enough to detect a dime through six to eight inches of wormrock, stable enough to require no adjustments on the bottom, and easy to handle under a 38 inch blower. No motion-sick meters to wiggle as the diver moved, but instead a single green LED light and an audible beeper that increased in intensity as the hand-held probe was moved closer to the object. The amplifier was small enough to strap under the diver's arm.

In May the water was still cold in Florida, and the visibility left much to be desired as the assault on the 1979 treasure diving season began. We centered our initial operations just outside the surfline in six to seven feet of water. Here the bottom conditions were extremely poor because of the deep sand and layers of clay. The waves crested and broke within a few feet of our anchorage and that combined with the nearness of the first reef and shallow depth made it necessary to use our smaller 26 foot boat, the *Pandion*. The draft of the *Pandion* was less than 3 feet, giving us enough clearance under the blower to work safely in shallow water. Our blower was a 24 inch pipe elbow constructed of aluminum, and hinged on the stern of the boat to swing down over the boat's propeller. When the boat's engine was revved up, the current of water was directed at the ocean floor, thus blowing away the sand like a minor sandstorm. It was effective in waters as deep as 25 feet, and the larger 38 inch blower on the *Bamboo Bay* could work in depths down to 40 feet. The coins and heavier artifacts stay in the hole, while the lighter sand and seashells are blown away.

In the early years of salvage here a cannon was located near the southern edge of the site and about 100 yards from shore. It was still there, covered by several feet of sand, and marked the shoreward limit of previous salvage attempts. We were determined to search inside the breaker line if necessary. We felt that the shoreline of 260 years ago hid a lot of the wreckage, and possibly treasure. Even with zero visibility, the metal detectors made it possible to locate coins or artifacts. We set our anchors far enough seaward to get a good bite of the bottom, making sure the lines did not pass over or around any sharp reef ledges. With the *Pandion* bobbing up and down as each wave passed under the hull, it was far more comfortable to be on the bottom fighting the poor visibility. Topside, our state agent, Harding Polk, was developing his sea legs as he braced against the constant motion of the sea to take bearings on our shoreline benchmarks. We began carefully working our way shoreward, expanding the trench in a conical pattern, and soon began to find silver coins. By the end of the first week, we had recovered well over 500 silver pieces of eight.

Expanding the search area to the south, we suddenly had a large anomaly on the metal detector, and in the half-light it felt like a large cannonball. As more of the object was uncovered, it proved to be the cascabell of an 8 foot cannon. Within a few feet we uncovered another, and then another, until we had a pile of five cannons, each covered with a thick layer of coral. It undoubtedly marked the spot where our galleon had come ashore. We suddenly had a problem: Our metal detectors were useless within several feet of the cannons. The cannons had to be moved out of the sea if we were to continue the search. Unfortunately, the prevailing winds of summer came early, and because of high waves it was impossible to move a larger boat in close to raise the cannon. We marked the spot with a special green colored float, and moved our dive operation out to the third reef. Here, in 40 feet of water, we had fairly good visibility, but the leftovers were pretty thin even with our sensitive metal detectors. One day we did notice that gray clay and sand were being blown out from under a large flat rock. It took several of us to roll the rock out of the way, and as the blower cleared the bottom of the hole we found over 400 more silver coins.

As the summer wore on we moved the operation around to several locations, trying to follow the banana pattern of the wrecksite. Once in awhile we would stop and scan the inshore reef, spotting the green float as it crested the waves over the cannon location. We all sensed that something special was waiting for us near that spot. On those days we prayed for calm weather, knowing it would take a high tide and flat seas to work a large salvage boat that close inshore. With the metal detector we recovered a few gold and silver coins, along with a number of unusual artifacts. One day Jimmy Janda emerged from the bottom with a large boarding sword, looking like King Neptune himself. Another day it was a crushed pewter mug, and a solid silver cupcake-shaped artifact that was later identified as a plug from the amalgum retorts of the Potosi silver mines. Silver coins were scattered here and there over a major part of the wrecksite, so it was not unusual to find 30 or 40 coins on a good day. Then, quite by accident, John Halas and his wife Judy made a bonanza find! The weather was the usual, windy and the waves were choppy. Close to shore the visibility was still limited to less than a foot, so John anchored out in the area where the coins had been found under the flat rock. He was working in a coquina rock formation when he had a fairly good hit with his detector. As he gently worked loose the layer of coquina shell rock, he exposed a beautiful, 1712 Lima gold two escudo. Within minutes another escudo gold coin was recovered. Before John or Judy could catch their breath, they had another hit that produced a large gold ring with an emerald over one-half inch square and still intact. For the next few days it was like Christmas in July, with 27 pieces of gold/worked jewelry coming up from the bottom. Many of the rings still had gemstones, rubies or emeralds, in their settings. One large earring had 11 pearl pendants, with gold chain connecting intricately worked gold filigree. A final climatic find was a gold Madonna. It had hung from a necklace and was an exquisite piece of worked gold. Six emeralds had once traced its base, but with the shipwreck and the sands of time, only two stones remained intact. The entire find of gold jewelry had been recovered from an area no greater than 20 feet across, and probably encompassed the personal possessions of a passenger aboard the *Rosario*.

After that stroke of luck our dive fever had no bounds. We were working in the hurricane season and the weather was always on our minds, but we were on the bottom even with small craft warnings flying. A long awaited break in the weather finally gave us an opportunity to move in close to shore. With the help of the Florida State Dept. of Antiquities, and flat calm seas, we were able to anchor a boat over the cannons near our green float. The cannons were raised, and later relocated in the State Underwater Park in the Florida Keys. Within hours we were working

(Continued on Page 92)

Shark Tagging Spectacular!

(Continued from Page 19)

If a tagged shark is caught at a later date, the tag is supposed to be sent to Scripps along with vital data on where and when it was caught. Data gathered from previous tagging efforts indicates that blue sharks have an amazing range. A shark originally tagged off Point Loma, San Diego was eventually captured in the Galapagos Islands, a distance of over 1100 miles.

Each team was given ten minutes to tag as many sharks as possible. The team was armed with a 24 inch long pole spear equipped with a quick release head, and a bandolier holding 33 stainless steel Marine Fisheries tags. Each team was made up of two divers; one designated as the tagger and the other as support diver. Each team was permitted to carry fish food for attracting the sharks to the competition area. Scoring for the competition consisted of three points for a dorsal fin tag, or one point for a body tag. Each team would be permitted to tag a specific shark only once, but each team could tag a shark which had been previously tagged by another team. The shark tags were clearly identified by colored plastic streamers which identified the origin of the tag. The Australians were equipped with orange tags, the Germans with yellow, and the Americans with blue.

Australia was represented by Ron and Valerie Taylor, the defending champions of the first shark tagging competition. The Taylors are world renowned for their underwater films of sharks and have an impressive list of screen credits including: *Blue Water, White Death; Jaws; Jaws II; Orca;* and the *Blue Lagoon.* Ron and Val have a great deal of experience tagging sharks for scientific studies conducted in Australia. They have even tagged three great whites, the tag of one of which was returned.

West Germany was represented by Herwarth Voigtmann and Helmut Debelius. Herwarth is a veteran shark handler who has been diving with sharks for the past 20 years. He was recently seen on the television special, *Mysteries Of The Sea,* hand-feeding reef sharks in the Indian Ocean. Helmut is an underwater photographer and writer who formed his own photo agency in Germany. He supplies many magazines with photos and articles. Neither Herwarth nor Helmut had ever used a pole spear because spearfishing is prohibited in Germany. Neither diver had worked with blue sharks either, but each felt confident that the blues would be easy to handle.

The U.S. team was Chuck Nicklin and Jack McKenney. Chuck is the founder and owner of the Diving Locker in San Diego, and is a 30 year veteran spearfishing champion. Chuck has worked with blues off California since 1965 and has made underwater films for the past 25 years. He has been involved with such projects as: *Gentle Giants Of The Pacific, Shark's Treasure,* and *The Deep.* Jack McKenney is a film producer, writer and photographer, published in many books and magazines around the world. Jack was formerly editor of SKIN DIVER, and now produces underwater films with his own company. Some of his films include: *Things That Go Bump In The Night, Fish Antics, U/W World Of California,* and *Ten Fathoms Deep.*

On Tuesday, June 4, the teams were given a practice day to warm-up for the main event. The deck crew and dive technicians carefully lowered the shark cage in the water and positioned it under the buoys. Meanwhile, the CBS television crew warmed-up their equipment for an open water test. A large steel chum container was lowered into the water to create a slick.

It was not long before the first blues started to appear, and soon there were 12 to 15 sharks circling the boat and cage. The pace quickened as the competitors began suiting up for their long anticipated encounter with the sharks. For some, it would be the first close-up view of the blue shark. Unlike other shark species, the blue moves with an almost casual nonchalance, acting indifferent to the bait or divers at hand. It was almost disquieting to watch their long, streamlined bodies move gracefully past you, carefully eye-balling each diver. Each team spent 20 to 30 minutes diving with the sharks and testing their tagging devices. The shark tagging pole spears had been greatly modified since the previous contest and were therefore completely new to all of the participants. This competition would be as fair and as evenly matched as possible.

The practice day turned out to be even more exciting than anyone had anticipated. The U.S. team found themselves confronted by a nasty mako shark with intentions other than those held by the contestants. Unlike the docile blue shark, the mako is considered to be very dangerous, and is often extremely aggressive in the open sea. The mako made several deliberate passes on Chuck Nicklin before being discouraged by Jack McKenney's powerhead.

A still more exciting incident took place while the Australian team was attempting to chum in a few friendly blues. While Valerie Taylor was intent on coaxing in a shark with an offering of mackerel, another blue sneaked up from behind and gently plucked a few mackerel off the fish stringer around her waist.

By the end of the day, all three teams were exhilarated at having confronted the blues and tested their equipment successfully. Anticipation for the coming day ran very high.

The main event began on Wednesday, June 5 at approximately 12:45 in the afternoon. It was a bright, sunny day with a gentle chop. Visibility was about 40 feet and there were at least one dozen sharks circling the cage. Conditions were perfect.

The three teams had drawn lots for position and the Australians had won. Displaying the cool concentration of the professionals they are, Ron and Valerie Taylor quickly slipped into the water and moved directly toward the shark cage. Valerie chummed the water with mackerel while Ron loaded his tagging device and stretched the pole spear rubber to the limit. Judge Paul Tzimoulis was positioned in the shark cage and the two cameramen kept their backs against the cage bars for protection. In addition, each cameraman had a safety diver beside him at all times watching for unexpected visitors. The contest began.

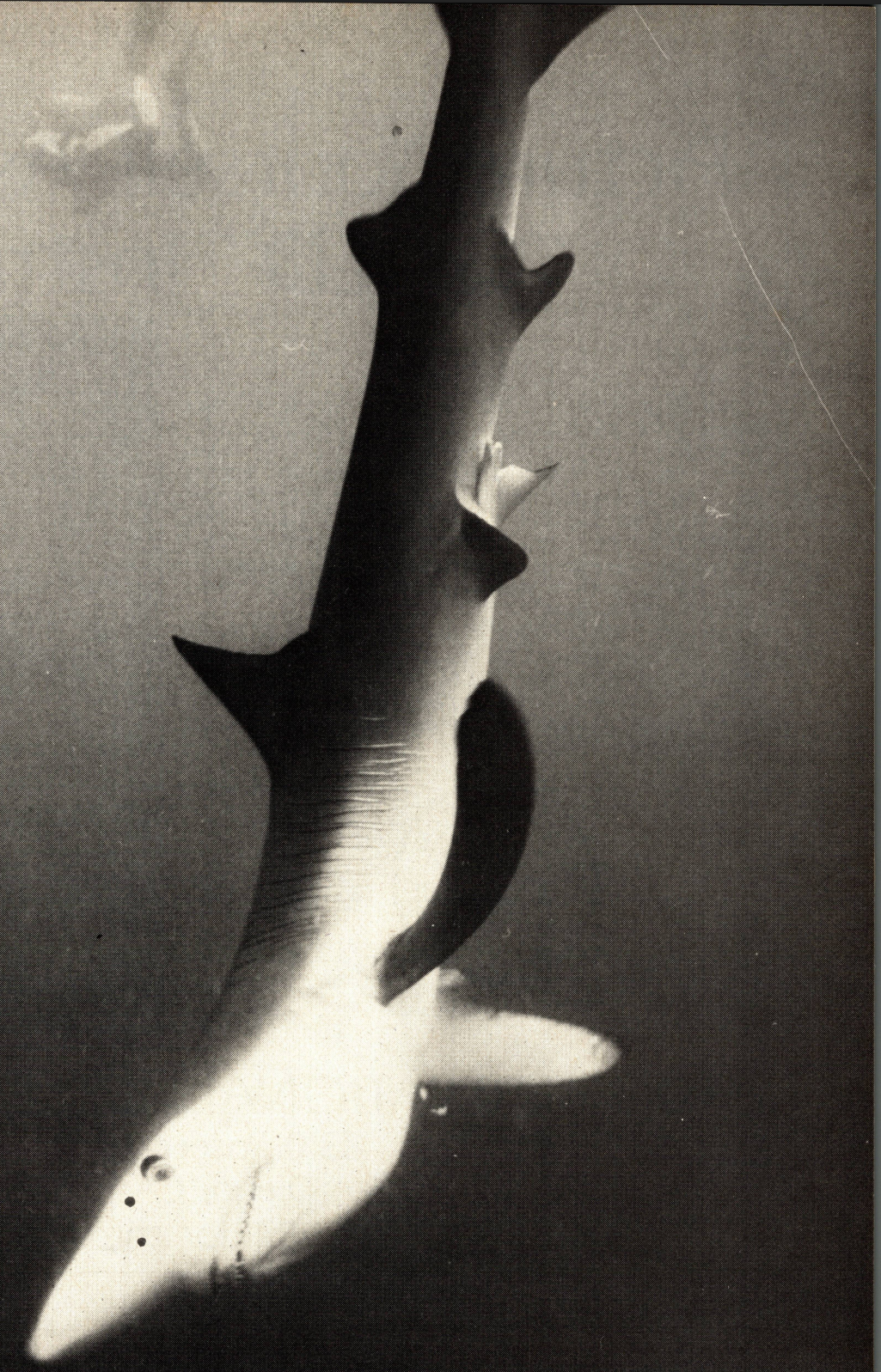
Ron immediately made several good tags, including two body tags and two dorsal tags. Intermixed were a number of misses, as the blues became more elusive. Their flexible bodies would bend and twist at a thousand angles, making it difficult to connect with a solid hit. For every tag that stayed in the shark, there were at least three or more misses. By the end of the first half of his ten minute time, Ron had made approximately six tags. It seemed to be getting harder and harder to approach the sharks or to find specimens which were still untagged. There were less hits now and many more misses. Some of the attempted tags were out of range of the judge's vision and the TV cameras. The pressure was almost unbearable, and one could see that Ron was frantically trying to make solid contact with a shark in the few remaining minutes of the contest. Then, it was over. The judge's flag announced the close of the ten minute time limit. The Australian team logged four dorsal tags and two body hits, for a total score of 14 points. The Australians had set the pace for what was to become a lively competition.

The second team into the water was the West Germans. Herwarth Voigtmann would tag, while Helmut Debelius chummed. Herwarth's first tagging attempt almost ended in disaster, as the shark tagging device unexpectedly flew forward and completely out of his hands. Herwarth's reflexes are quick and he managed to spring forward and grab the pole spear before it sank into the 2000 foot depths. It soon became apparent

that the Germans were having a great deal of difficulty operating the tagging device. The tags were not piercing the sharks' skin, but instead bouncing off because of the sideward angle of contact. Herwarth managed to make two dorsal tags but had a frustrating dozen or so misses. You could see the tension building each time he missed, thus causing even greater difficulty on the next attempt. Frequently Herwarth ripped away the stainless steel tag from the tip of his pole spear and replaced it with a new one — hoping it would be sharper than the last. Perhaps the greatest difficulty was the blue shark's dorsal fin; it was so flexible that it actually bent completely over when struck by the shark tagging device, resulting in a miss. It was like trying to spear a wet noodle with a cardboard fork. At the end of the competition the West Germans were terribly disappointed.

The last team into the water was Jack McKenney and Chuck Nicklin, representing the U.S. Chuck acted as support diver and chief chummer, while Jack operated the tagging device. From the very beginning it was apparent that the American team meant business. McKenney was incredibly aggressive, pressing forward for every shark tagging opportunity. Within minutes he made four dorsal tags — each with uncanny accuracy. Every tag was placed squarely in the center of the shark's dorsal with the grace and ease of an expert swordsman. Meanwhile, Chuck Nicklin lashed a large bag of chum to the very front of the shark cage and shook it vigorously in the hope of attracting more targets. The American team's strategy was indeed unique. They attracted the sharks directly to the front of the cage and to the TV cameras, thus assuring a full documentation for maximum scoring. McKenney never slowed his pace, but instead kept pressing his advantage with dorsal tag after dorsal tag.

At one point the competition endured an unexpected turn of events. An enterprising blue shark decided to grab the chum bag and attempted to make a run for it. Instead, the shark's teeth became entangled in the mesh of the chum bag and it then proceeded to thrash violently against the front of the shark cage; almost working its way inside the cage and alongside Paul Tzimoulis. Fortunately, he was able to slam the door on this uninvited guest, while Nicklin became engaged in a tug of war over possession of the chum bag. The shark finally broke free but was unable to make its escape before McKenney neatly placed a tag in its dorsal fin. By the end of the ten minute tagging session, the American team was credited with 12 solid dorsal tags for an incredible score of 36 points. The U.S. team walked away with this year's contest — and the $2000 first prize.



Postscript — If you are still skeptical about the sanity of divers who play games with wild sharks, you have every right to be. Barely two weeks after the conclusion of this year's incredible shark tagging contest, Valerie Taylor was bitten on the leg by a four to five foot shark while diving in the very same location. She and her husband Ron had returned to the channel in the hopes of shooting underwater movie footage of Valerie hand-feeding blue sharks. Never let it be said that a shark will not hesitate to bite the hand that feeds it!

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Scuba Quiz

Category: Buoyancy

By Dennis Graver

Buoyancy Control Devices (BCD's) have become a required piece of equipment within the past decade. The technological advancements of this item of equipment have been significant. Test your knowledge of BCD's by answering the following questions. It may be that you don't know all that you need to know. Answers are on the next page.

1. Select the *true* statement:
- ☐ A. Carbon dioxide does not provide much buoyancy at depth because it is more compressible than air
- ☐ B. It is dangerous to hold onto a heavy object and use your BCD to salvage it
- ☐ C. When a diver is out of air, a low pressure inflator cannot be used to inflate a BCD
- ☐ D. The greater the volume of a BCD, the better it is for the user

2. Rupture of a BCD during an ascent would most likely be caused by:
- ☐ A. A manufacturing defect
- ☐ B. Too rapid a rate of ascent
- ☐ C. An undersized BCD
- ☐ D. Lack of a pressure relief valve

3. The most significant advantage of a low pressure inflator mechanism is that it:
- ☐ A. Does not require the diver to remove the regulator from the mouth
- ☐ B. Allows buoyancy to be controlled with only one hand
- ☐ C. Requires less air for the control of buoyancy
- ☐ D. Both A and B are correct

4. Flaring the arms and legs while horizontal in the water is done to:
- ☐ A. Slow a runaway ascent
- ☐ B. Perform a controlled buoyant ascent
- ☐ C. Demonstrate control of buoyancy
- ☐ D. Signal loss of buoyancy control

5. When swimming on the surface with a front mounted BCD, the device should be:
- ☐ A. Fully inflated
- ☐ B. Half inflated
- ☐ C. Deflated
- ☐ D. Gradually inflated

6. If a CO_2 cartridge provides 32 pounds of lift at the surface, at a depth of 99 feet it will provide a lift of:
- ☐ A. 8 pounds
- ☐ B. Less than 8 pounds
- ☐ C. 16 2/3 pounds
- ☐ D. 32 pounds

7. Select the *least* significant factor for maintenance of a BCD:
- ☐ A. Keep BCD inflated for storage
- ☐ B. Rinse internally and externally after use
- ☐ C. Store in a cool, dark, dry location
- ☐ D. Remove, inspect, lube, and replace CO_2 cartridge

8. Select the *true* statement regarding BCD's:
- ☐ A. A person using a new type of BCD should receive training in its use
- ☐ B. Large volume BCD's present more resistance to movement in water than small BCD's
- ☐ C. With training and practice it is possible to use a BCD as a rebreather in an emergency situation
- ☐ D. All of the above statements are true

9. A diver who is neutrally weighted at the surface is eight pounds negatively buoyant at 66 feet due to suit compression. With the BCD adjusted for neutral buoyancy at 66 feet, what would the diver's buoyancy be upon surfacing from a runaway ascent from that depth?
- ☐ A. Neutral
- ☐ B. 8 pounds positive
- ☐ C. 24 pounds positive
- ☐ D. 32 pounds positive

10. A diver who is overweighted by eight pounds at the surface loses an additional eight pounds of buoyancy at a depth of 66 feet due to suit compression. With the BCD adjusted for neutral buoyancy at 66 feet, what would the diver's buoyancy be upon surfacing from a runaway ascent from that depth?
- ☐ A. 16 pounds positive
- ☐ B. 32 pounds positive
- ☐ C. 40 pounds positive
- ☐ D. 48 pounds positive

scuba Quiz

Answers: Buoyancy

1. B. It is dangerous to hold onto a heavy object and use your BCD to salvage it. More on CO_2 later. A diver out of air can inflate a BCD during ascent as ambient pressure decreases. If holding a heavy object with BCD inflated, a dangerous runaway situation will occur if the object has to be released or slips out of the diver's grasp.

2. D. Lack of a pressure relief valve. Every diver should wear a BCD and a BCD worn by a scuba diver needs to have a pressure relief valve to handle overexpansion. Prior to the development of the valves, accidents occurred following ruptures of buoyancy compensators.

3. D. Both A and B are correct. It is much easier and safer to control buoyancy with a low pressure inflator than to control it manually. Time and energy can be saved and panic can be prevented. Low pressure inflators are valuable and recommended.

4. A. Slow a runaway ascent. Divers are frequently carried to the surface out of control. If you cannot dump the air from your BCD and regain control, flare out spread-eagle to increase cross-sectional area and slow your ascent.

5. B. Half inflated. Buoyancy at the surface is desirable, but too much air in a BCD increases drag and causes the diver to be unstable. If you tend to roll to the side while swimming, you need to vent some air from the BCD.

6. A. 8 pounds. It is a misconception that CO_2 provides less lift at depth because it is more compressible than air. This only applies at very high pressures beyond those encountered at diving depths. The amount of lift is determined by Boyle's Law. The volume at 99 feet (4 ATM) is ¼ the volume at the surface or eight pounds.

7. A. Keep BCD inflated for storage. Some of the first buoyancy devices were made of rubberized material and tended to stick together inside unless kept inflated. Modern BCD's are made from space age materials that do not stick together so easily.

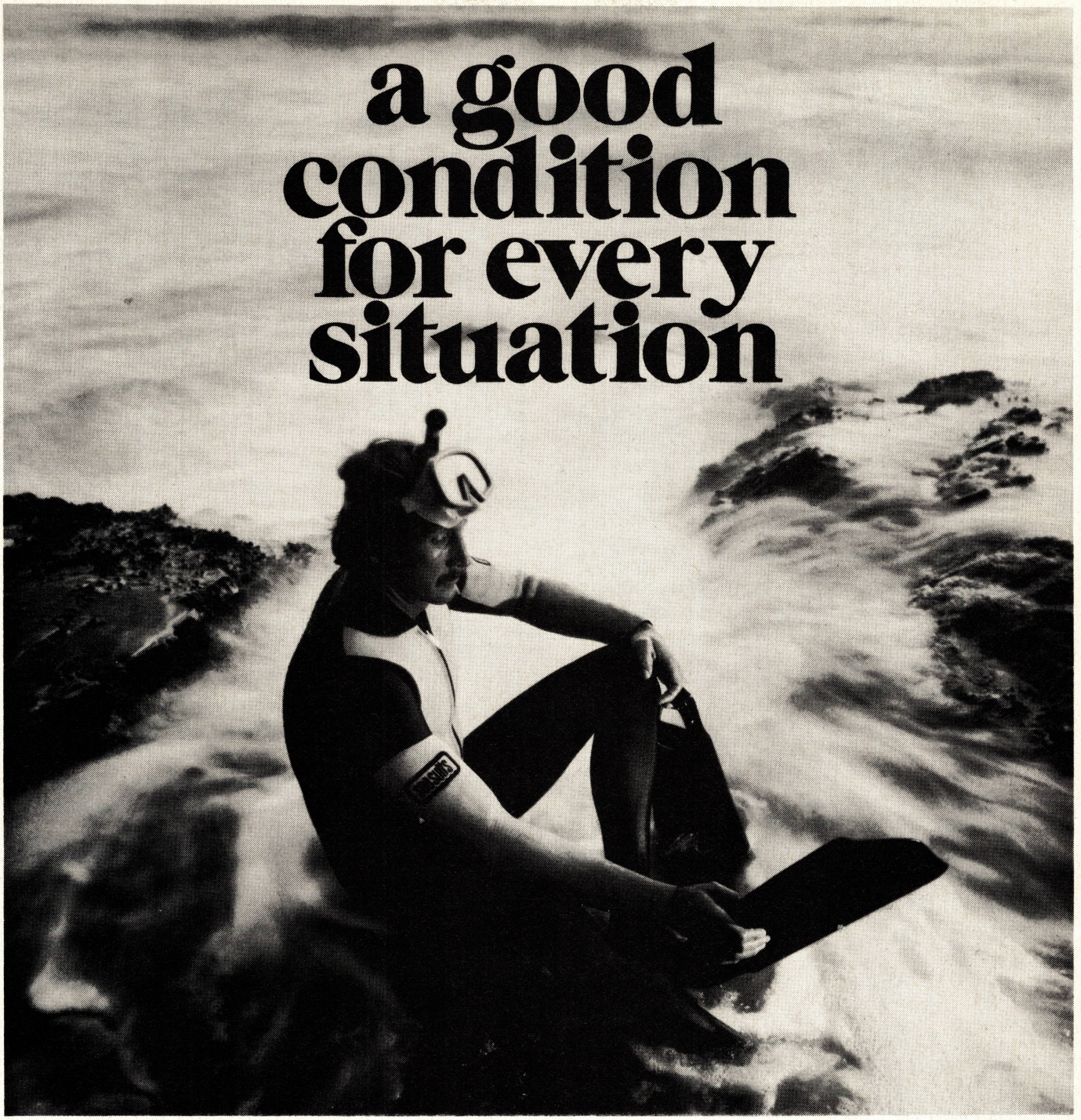
8. D. All of the above statements are true. The most important of these statements involves training. Much of the sophisticated buoyancy control equipment available today requires an orientation in a controlled environment prior to use in open water. Professional dive stores offer training for the BCD's they sell.

9. C. 24 pounds positive. To achieve neutral buoyancy at 66 feet, ⅛ cu. ft. of air is required. This air will triple in volume during the ascent and end up as ⅜ cu. ft. or 24 pounds of buoyancy. Excess air needs to be vented during ascents to maintain control.

10. C. 40 pounds positive. Here is one danger of overweighting. At 66 feet ¼ cu. ft. of air is required in BCD. This expands to ¾ cu. ft. at the surface. The diver's buoyancy is then 48 pounds less the eight pounds of excess weight. Compare this situation to the last question and note the difference in buoyancy during ascent. It is not just eight pounds . . . Avoid overweighting for diving. It is far too common a practice.

To use BCD's properly, a diver needs to understand diving physics, be trained in the use of the BCD selected, and practice using that BCD frequently. A good test of buoyancy control is to see if you can hover motionless between the surface and the bottom by controlling buoyancy. After a long period of inactivity in diving, practice buoyancy control in a pool before making a dive.

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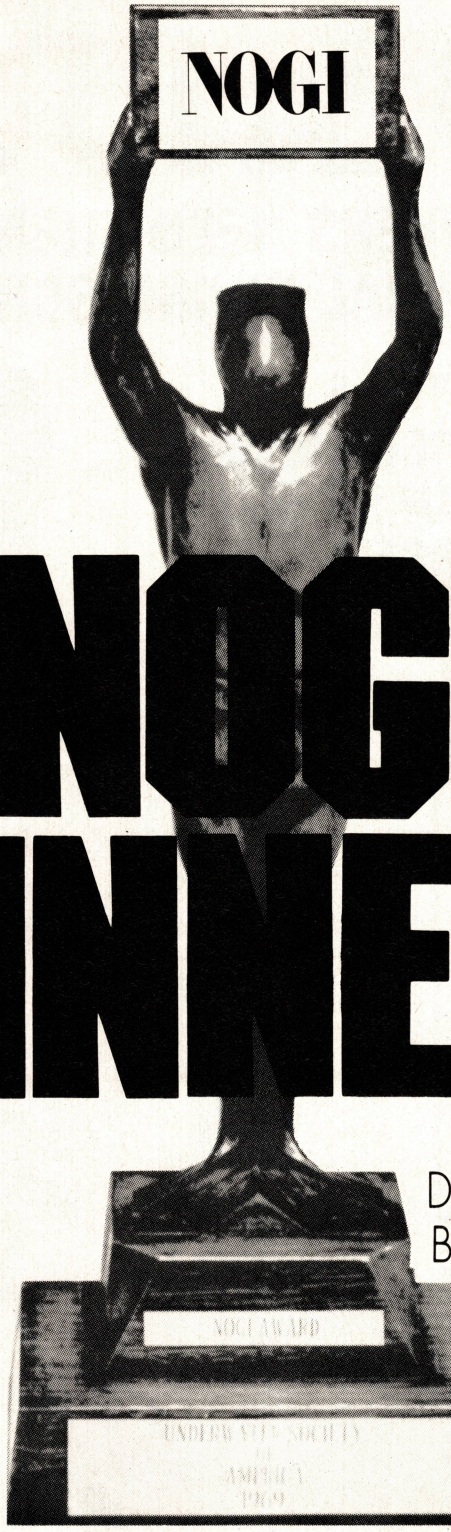
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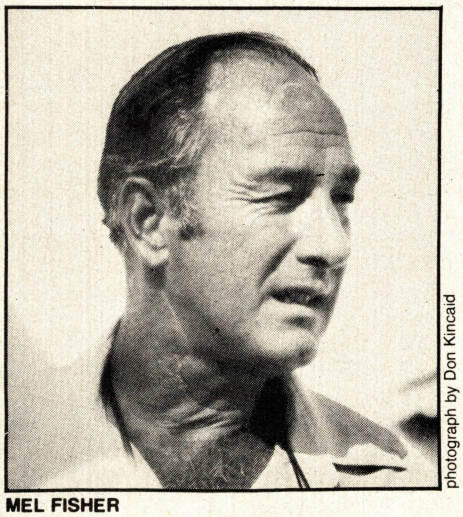
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By Bonnie J. Cardone

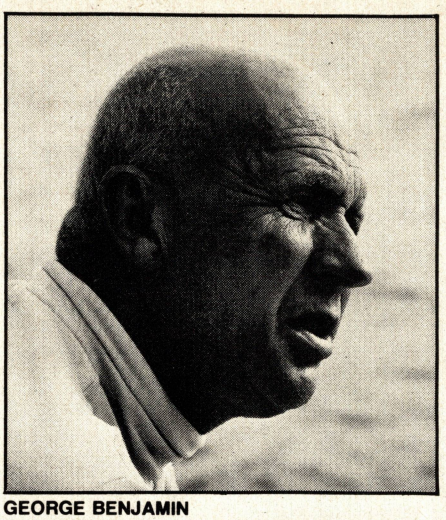
It doesn't have the glitter and glamour of Hollywood's Oscar, but the NOGI does have an equally impressive list of recipients. These men and women are known the world over for their accomplishments in the field of diving. They are scientists, educators, underwater photographers and cinematographers, writers, commercial divers, doctors, treasure salvors and others who have made some aspect of diving their life's work. There are only 80 of them, but they represent diving's past, present and future.

The NOGI awards were instituted by the Underwater Society of America in 1960. At that time, Jay Albeanese, Jr. and Louis Cuccia volunteered to provide the statuette that was given to the winners. The statuette was originally designed for the New Orleans Grand Isle spearfishing tournament, held around the oil rigs off New Orleans' Grand Isle. The spearfishing tournament was discontinued some years ago, but the NOGI awards live on. After Jay Albeanese died in 1971, the Underwater So-



MEL FISHER

photograph by Don Kincaid



GEORGE BENJAMIN



CONRAD LIMBAUGH

photograph by Nan Limbaugh Blackridge



DAVID DOUBILET

photograph by Anne Doubilet

ciety of America became the sole sponsor. Last year, however, SKIN DIVER Magazine agreed to become a NOGI co-sponsor.

To the illustrious list of NOGI award winners four names have been added. These are: David Doubilet, Mel Fisher, Conrad Limbaugh and Dr. George Benjamin.

DAVID DOUBILET—ARTS

David Doubilet is known worldwide for his photography. His pictures appear regularly in National Geographic Magazine. His success story is one that involves perseverence. He simply refused to give up until he got what he wanted. Doubilet began diving when he was 12. Quite early in his life he decided to become a marine biologist/underwater photographer. He began submitting photographs to National Geographic while he was still in college, but without notable success. However, in 1971 Stan Waterman invited him to go to the Red Sea to photograph Eugenie Clark's study of garden eels. The resulting story was sold to National Geo and David Doubilet was on his way. He and his wife, Anne, reside in New York.

GEORGE BENJAMIN—DISTINGUISHED SERVICE

A Canadian, George Benjamin is a pioneer cave diver and blue hole explorer. He has been diving since 1928 and is still active in the sport. He developed special safety equipment for cave diving and invented the Benjamin Conversion, which consists of two tanks, two regulators attached to a double tank block that is interconnected below the valves. He discovered the world's largest undersea cavern and was the first to see, and correctly identify, underwater stalagmites and stalactites.

Dr. Benjamin has made more than 2000 dives to depths greater than 150 feet, and excursions into caves more than 1000 lateral feet, without mishap. He has examined more than 60 blue holes in the Bahamas and has produced four films on this subject which he uses during lectures to clubs, U/W film festivals, scientific meetings and public shows.

MEL FISHER—SPORTS/EDUCATION

The name Fisher is almost synonymous with treasure. Mel has spent nearly 20 years searching for the gold and silver of sunken Spanish galleons. He spent more than a decade looking for the *Nuestra Senora de Atocha,* which disappeared in 1622. The wreck was eventually found and part of her huge treasure recovered, but not without tragedy: Fisher's son, Dirk, and daughter-in-law Angel, died during the quest.

Fisher was once a chicken farmer in Southern California. Later, he owned and operated Mel's Aqua Shop in Redondo Beach. One of the first dive shops in the U.S., it is still in business as Sea d' Sea. Always enterprising, Fisher bought a San Diego fishing boat, renamed it the *Golden Doubloon,* and converted it for diving, thus creating one of the first dive charter boats. The *Golden Doubloon* still plies Southern California waters carrying divers to and from the Channel Islands. Before diverting his considerable energies to treasure hunting, Mel initiated river gold diving, developed the first scuba training film, and was a pioneer in the field of underwater cinematography. He had his own TV show for four and one-half years on which he showed movies he made of his own underwater adventures.

CONRAD LIMBAUGH—SCIENCE

Conrad Limbaugh was awarded his NOGI posthumously. Although he died 20 years ago, his contributions to diving keep his memory alive today. A marine biologist for Scripps Institute, San Diego, his eyewitness account of symbiosis opened the door to a whole new era of oceanographic field investigation. He made many contributions to a variety of marine sciences and was largely responsible for developing interest among American scientists in scuba techniques. The first scuba instructor, he developed a scuba instruction program that is still considered the model for all the rest. He organized and was the first president of Scientific Diving Consultants and was recognized internationally for his contributions to dive safety. He was a charter member of San Diego's Bottom Scratchers, America's first dive club. Mystery still surrounds his death, which occurred during a dive in a Mediterranean cave, in 1960.

Decompression Stop

Buddy Diving

As a semi-professional sport diver with 16 years experience, I'd like to comment on Dick Anderson's article, Buddy Diving, in the August issue of SDM.

Dick refers to this universally accepted and enforced diving rule as, "a pain in the butt." It's more serious than that. In my personal, opinionated opinion, buddy diving is the most overrated, overemphasized and potentially dangerous, so-called "safe" diving practice that the certification organizations ever invented. Why? Because diving with a buddy, *any* buddy, is frustratingly difficult even under the most ideal water conditions; especially for nervous novices. The problem, apart from inexperience, is basic communication which, underwater, is almost totally nonexistent. In an emergency situation, where seconds count, by the time a distressed diver gets the message across to his or her buddy, about all the buddy can do is swim the body back to the boat or the beach.

It's a proven fact that within 30 seconds after reaching the bottom most dive teams become separated. Nearly two-thirds of all buddy dives are spent trying to relocate the constantly vanishing buddy. Instructors may call that safe diving but I call it just plain stupid. And again: very dangerous.

So what's the solution? Very simple — *Self Reliance*. The gospel according to a wise, old diver: Know thyself, know and respect thy limitations, know and respect thy gear, know the water conditions into which you're diving, be cautious, be conservative, dive with a buddy *only* for companionship and not for the false security of mutual survival, and finally, never, *ever* let a cop-out divemaster assign you to a buddy you've never dived with before. That's the sport diving equivalent of Russian roulette.

One of the fatal flaws in the teaching of the buddy system is that rarely are emergency procedures practiced in the situations in which they're most apt to occur. That leaves it up to the individual diver to practice those procedures on his or her own. Again, the value of self reliance. This is especially true of inland divers venturing into the marine environment for the first time.



For the past ten years I've been actively diving with the California Wreck Divers, a club which dives exclusively on Pacific Coast shipwrecks. It's exciting and fascinating. It's also a solid ten on the potentially dangerous diving scale: murky, surgy, razor sharp steel, collapsing superstructures, often deep and cold. It makes Florida cave diving seem like a pool check-out. Big deal? You bet your bottom timer. After ten years and many thousands of hours probing the guts of these wrecks, this rather unique sport diving club has not sustained a single injury or fatality. Think about that. Not even *one*. That's almost entirely due to the safety edge of self reliance. When our charter boat pulls away from the dock in the wee hours of the morning, we leave our buddy systems at home in bed. Sure, we give each other a helping hand removing artifacts down there but that's about the extent of it.

So remember: There are old divers and there are bold divers, but there are no old, bold divers. Dive with self reliance first and a buddy second. If you do you'll end up an old diver. Just like Dick Anderson. And me.

FRANK FARMER
VAN NUYS, CA

I enjoyed Dick Anderson's piece on buddy diving. Since both of us have dived commercially, sometimes together, we have talked about buddy diving on occasion and we both feel the same way. I suspect I could write a book about how many of the "rules" for "safe diving" got started in the early days of the sport, but I won't — at least for awhile.

E. R. CROSS
TECHNIFACTS EDITOR

Hooray for Dick Anderson! . . . I have been talking that way about buddy diving for some time now, but generally get only blank stares in response ("but I was taught that way"), or provoke angry retorts. No one, however, has been able to provide sufficient good reason for diving with a buddy. If I'm in trouble, I'm not going to wait around to find out whether or not my partner knows how to buddy-breathe — I'm going to head for the surface; probably the quicker route anyhow. Since physical entrapment would prevent this, I am extra careful, when by myself, not to get into any tight spots. I do a lot of diving, mostly research diving, and sticking close to a buddy and getting anything done is virtually impossible — and, again, I question the value of the other person in the first place. I applaud SKIN DIVER for publishing this article and would like to see a synopsis of the reactions received by you.

JAYNIE BELNAP
SANTA CRUZ, CA

Hooray for Dick Anderson . . . I see nothing "radical" or "controversial" about his article. I applaud it for expressing the essence of what I think diving is all about.

Now, if I had been talking to this Ph.D., I'm sure both terms would strongly apply. Since I know how to govern myself, I don't need any suggestions from governments of any nature pertaining to anything.

LYNN SECORD
MIAMI, FL

Let me say I agree 100 percent with Dick Anderson, especially about individual freedom taking precedence over safety by restriction.

NORINE ROUSE
WEST PALM BEACH, FL

In regard to your article, "Buddy Diving, Only for the Lonely?" I agree wholeheartedly with every word, every preposition! I've been diving for 24 years, and have had only one accident — and a serious one it was! I was diving under a foot of ice with my buddy. To make a long story short, this individual dove with 600 psi of air in his tank — unbeknownst to me. He ran out of air 40 ft. down, and came to me for air. I passed him my mouthpiece, and as I did, he knocked my mask off in his panic. Naturally I was blinded. He then disappeared while I struggled to find my mouthpiece. Luckily, I was able to crawl along the bottom until I came to the edge of ice and land. I banged my tank against the ice and those on top cut a hole large enough to get my head through. Later, I found my buddy on the surface.

I'm extremely safety conscious, and I now dive alone when I'm able. I enjoy diving more without the restrictions of a buddy. Every year I make a dive trip to the Caribbean, and on two occasions my trip was ruined because of an incompetent dive buddy.

In the old days we never had all the

fancy equipment available today — yet divers made out well, with fewer injuries and fatalities than today. I'm glad someone like Dick Anderson wrote the article — it did my soul good to read it.
NAME WITHHELD

We live in a country of free speech and the right to one's own opinion. In response to an article entitled: Buddy Diving — Only For The Lonely, by Dick Anderson, I quote, "I think buddy diving is a pain in the butt. I would rather dive alone and die alone. And I probably will." What kind of attitude is that?

I understand in certain commercial diving situations a buddy team may not be used because of the type of work, cost involved, or other circumstances. However, we are sport divers! Not employing the buddy system is a denial of safe diving practice. The buddy system must be exercised to be effective. Both members of the team must have the experience to feel comfortable with each other. I don't believe a buddy team must have a dominant diver and a subordinate diver, as Mr. Anderson stated. Safety is of utmost importance, and the buddy system should be one of our most perfected underwater procedures.

According to the most recent U.S. underwater fatality statistics, conducted by the University of Rhode Island, out of the 116 recorded scuba related deaths in 1978, six of them were diving without a buddy. That's certainly an unlucky six too many! I quote Mr. Anderson, "If someone wants to dive alone it is his right to do so, even if he drowns doing it." It seems to me that kind of attitude increases fear of potential new divers, possibly raises the cost of insurance for instructors and shops, and goes against a cardinal rule in sport diving.

Your viewpoint is obviously radical. I hope I can speak for all instructors and divers alike. The buddy system has worked for the majority of us and I intend to continue practicing it. I cannot think of one time I wanted to be a "lonely diver."
SCOTT R. LEVIN
LOS ANGELES, CA

I was appalled to see the article concerning Dick Anderson's reckless attitude toward buddy diving printed in your magazine. Diving in pairs is a commandment, and never an individual predilection, for the responsible sport diver.

While it seems there will always be foolhardy divers — and it takes but a few to tarnish the image of this marvelous, safe, aquatic sport — you are irresponsible for gracing the pages of SKIN DIVER with such audacity. Your disclaimer of support is an insipid defense. Although Mr. Anderson may be an expert diver, and though he certainly can choose whether to drown himself, his degree of experience is not an acceptable reason for publicizing such unorthodox views.
ANDREW VOGEL
CLAREMONT, CA

Scuba Quiz Correction

In the July, 1980, SKIN DIVER, question number ten on the Scuba Quiz asked for the total crushing force on a cubical container measuring ten inches per side, sealed at atmospheric pressure, and taken to a depth of 20 feet in the ocean. The answer calculates the problem with an area for the container of only 600 square inches instead of 1000 square inches (10 X 10 X 10 inches = 1000 square inches.) The correct answer should be 8900 pounds. It is figured as follows: The absolute pressure at 20 feet is .445 psi/ft. X 20 ft. = 8.9 psi + 14.7 psi = 23.6 psia. The total pressure on the outside of the container is 23.6 psia X 1000 sq. inches = 23,600 pounds. The pressure on the inside of the container is 14.7 psia (atmospheric pressure) X 1000 (same area) = 14,700 pounds. With 23,600 pounds pushing inward and 14,700 pounds offsetting the outside pressure, the difference or crushing force on the container is 8900 pounds.

When creating the problem, I figured it using a container 10 X 10 X 6 inches, and then forgot the dimensions when I wrote the question. At least the answer specified, choice C, was the most correct answer! I apologize for any confusion the answer may have created. Now if you'll excuse me, I'm going to go ask my reviewers why they didn't catch the error.
DENNIS GRAVER

Is A Knife Necessary?

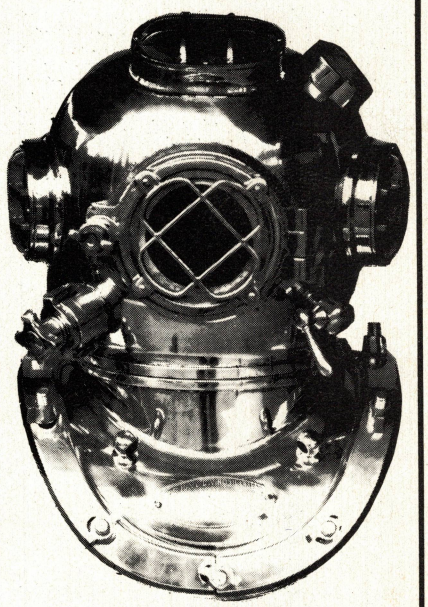
I read with interest your June editorial: The Definition of a Good Diver. Your efforts to improve dive safety in past editorials have been numerous and, I am sure, successful.

About one year ago I wrote concerning requiring a knife as a piece of necessary equipment . . . I note in your June Editorial that under "proper equipment" you omit the knife, and include octopus rig, depth gauge, submersible pressure gauge, etc. My question is: Do you class the knife as optional equipment?

The knife has been instrumental in saving my life on two occasions. And, in 1978 I had to cut my buddy free of a gill net in Puget Sound. U.R.I. statistics in '70-71 documented 16 entanglement deaths, with only two divers wearing knives. I sincerely believe that this data should be regarded as conclusive evidence of the importance of a dive knife. Failure to include the dive knife as basic equipment could be forgiven during the formative years of dive safety rules, but certainly not now!
BOB SHEATS
POULSBO, WA

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Rx FOR DIVERS

BY CHARLES V. BROWN, M.D.

POTPOURRI

We have been advised that the Scuba Queen Hood, discussed in July's Rx for Divers, is no longer manufactured by Henderson Aquatics. Divers interested in the Scuba Queen Hood should contact: Global Manufacturing Co., 1675 S. 43rd Street, Milwaukee, WI 53214. (414) 645-1800.

Susan Eschenbach of Sarasota, Florida has a dive trip all planned, but now it turns out that she's pregnant. Will diving be dangerous?

Answer: It could be. Animal studies and a survey of women divers suggest that the fetus may be at increased risk of decompression sickness from dives that are safe for the mother. Therefore, many authorities now advise against any diving during pregnancy. Our personal opinion is that ordinary dives not exceeding 30 feet won't introduce any significant hazard.

Question: At 22, Eric Ell of Portland, Oregon had long been diving and playing football without serious injury. Then he ruptured his fourth lumbar intervertebral disc in an on-the-job accident. This caused some weakness and loss of feeling in his right leg. An operation was successful. He recovered rapidly and is now swimming and bicycling with no symptoms at all. Before he resumes diving, however, he wants to know whether the injured area will be at increased risk of a bends hit.

Answer: There are no statistics to back up an answer. It has been reported that injury makes a limb more liable to bends, presumably because of less efficient circulation. The situation with a ruptured disc may not be analogous. Actually the disc itself, a cushion between two vertebrae, does not rupture. The ligament that retains it ruptures, allowing part of the disc to protrude out and push on a spinal nerve root. Since your surgeon removed the protruding material and you promptly regained normal strength and feeling, it seems reasonable to suppose the circulation to the nerve root is now normal and there won't be any bends predisposition.

In the future, should scar tissue envelop the nerve root or should you have another disc protrusion, bends predisposition may exist. We're optimistic about your case, but caution prompt consultation if any symptoms appear.

Question: Ear squeeze is the commonest medical problem in diving, and we've commented many times on how to handle it. Now Jose Illan of Gaithersburg, Maryland comes up with a new twist. What do you do if one ear clears easily and other doesn't?

Answer: It's a good question. A lot of divers have unequal eustachian tube function and find that one ear clears more readily than the other. Most of them simply persist with their usual clearing maneuver until the stubborn tube opens up. This is OK if it's done cautiously, to avoid over-pressurizing the easy ear. You don't want to risk a ruptured eardrum or window. If the reluctant side is too stubborn, try these strategies to soften it up: Spray a decongestant such as Afrin into the nostril on the same side; or lie on your side for five minutes with the sluggish ear up. If the problem proves persistent you many need a surgical cure, so see a specialist.

Question: A group from Madison, Wisconsin is heading for the Galapagos. They understand that they'll be sharing the water with a sizeable resident shark population. Ought the women stay dry during their menstrual periods?

Answer: Whether menstrual blood is an effective shark chum is an old question that keeps popping up. We can find no evidence to support a yes answer, and so agree with most authorities in saying probably not. However, fresh blood may attract sharks, and there is a possibility that women with abnormally heavy flows may excrete blood and tissue fresh enough to put them at risk. It's generally agreed that a tampon is a good idea.

Question: A young man discovered that during a dive one of his testicles disappeared. It returned afterward, so his panic has subsided, but he's understandably concerned.

Answer: When you were an embryo, your testicles formed within your abdomen then later descended into your scrotum. Apparently nature arranged it that way because testicles function best at a temperature a little below that of the rest of the body. After they find their permanent home, the communication between abdomen and scrotum shrinks to become a narrow channel called the inguinal canal, which accommodates the spermatic cord. The cord provides the tunnel through which mature sperm exit in quest of an ovum to fertilize. It also includes the cremasteric muscle, which pulls the testicles up close to the body for warmth when the outside temperature gets too low. Ocean temperatures are usually too low, so divers' testicles usually do retract upwards. In a few people the cremasteric reflex is extra strong and the lower part of the inguinal canal extra wide, so upon exposure to cold the testicle seems to disappear. This is of no importance and can be ignored — as long as it shows up later.

Question: Jessie Johnson of Gulfport, Mississippi wants to know if holding in you stomach will increase the chance of air embolism. It's a habit he's developed.

Answer: This question takes me way back to Navy boot camp. Suck in your gut and throw out your chest. The military bearing. The posture of health and the carriage of pride. The ladies had their own version, substituting corsets for muscle tone.

Aside from cutting a more dashing figure, the main effect of tightening your abdominal musculature is to elevate your diaphragm. Since this will reduce lung volume and airway diameter a little, one could theorize a slightly increased chance of air embolism. If it's real at all, it's negligible. Anyway, you won't be thinking about your stomach underwater. Go ahead and take the course. You'll probably be the most photogenic graduate.

Question: Susan Mori of Ottawa, Illinois is 13 years old and eager to start diving or at least snorkeling. Because she wears braces, her father says no — nothing in the mouth. If she can find a mask with built-in snorkel, that'll be OK.

Answer: Considering the cost of orthodontal care, we can understand papa's concern. However, outside a museum, we wouldn't know where to look for a decent mask with built-in snorkel. The few we've seen were cheap affairs that we wouldn't trust. But using a regular snorkel would not put any strain on your teeth if you don't bite on it, which you're not supposed to do anyway. See if your father will relent. A scuba regulator, much heavier and subject to pull by its hose, is another matter. Don't push for it until your dentist agrees that your teeth are ready.

READER FEEDBACK

The value of this column is enhanced by reader feedback. Dr. Ury Kallayee, a Baltimore ENT specialist, has written to share his views on several subjects.

For those who have had a pituitary operation through the sphenoid sinus approach (we've heard from several), he counsels no more diving. He fears that diving could invite contamination of the cerebrospinal fluid with sea water. We think this unlikely, but since there is no firm evidence one way or the other, reliable advice cannot be given.

For divers subject to unexplained episodes of vertigo, he advises a careful dental evaluation. It seems that habitually chewing on the same side can make a diver dizzy. The problem might be physical — missing teeth or an oversized tooth — or psychological, just a habit. For example, chewing gum addicts favor one side. Constantly clenching and grinding one's teeth, a habit grandma ascribed to pinworms but more likely due to nervous tension, can also produce dizziness. Apprehensive divers who clamp down on snorkels and regulators fit the pattern. The solution: Counseling and/or the ministrations of an orthodontist.

Divers who have trouble clearing one ear but not the other should check their chewing habits too. Dr. Kallayee believes that too much munching on one side can cause spasms of the opposite internal pterygoid muscle, compressing the eustachian tube. The cure is to kick the gum habit, or give equal time to each side.

These days a lot of people get the x-ray study, known as an upper GI series, to find out if they have an ulcer. Quite commonly a hiatus hernia is discovered — that is, part of the stomach protrudes through the diaphragm into the chest. Divers who do not tend to regurgitate or have heartburn needn't take this diagnosis too seriously. Some people with hiatus hernia never have symptoms, while some with normal x-rays do. Therefore, advice about safety underwater should be based more on the history than on x-ray findings. We might add that vomiting underwater needn't be catastrophic if properly handled. The safest way is to remove the regulator, vomit, replace the regulator, and don't forget to purge it before inhaling.

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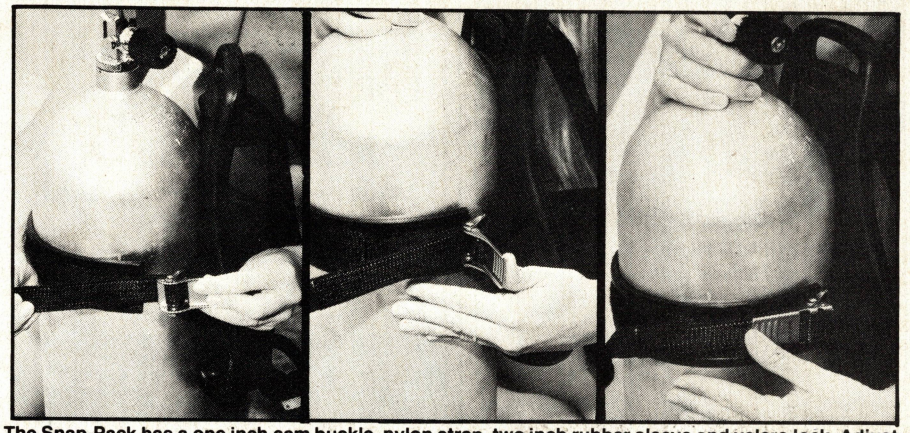
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AQUA-CRAFT'S SNAP-PACK

By Jim Pearson



The Snap-Pack has a one inch cam buckle, nylon strap, two inch rubber sleeve and velcro lock. Adjust the harness by weaving the strap through the buckle, and pushing the cam down — locking the tank in place.
photographs by Emerson Mulford

How would you like a backpack that would easily fit virtually every size tank diameter, hold a tank firmly in place, reduce bulk and weight, and still be so simple to operate that no tools are needed? Aqua-Craft has answered your wish.

The Snap-Pack incorporates a one inch cam buckle, nylon strap, two inch rubber sleeve and velcro lock. I was skeptical at first, believing that the velcro material was designed to hold the tank in place — it is not. Keeping the buckle close to the backpack — therefore allowing maximum contact between the tank and rubber sleeve — the diver adjusts the nylon harness to the tank diameter by weaving the nylon through the buckle. The cam is then pushed to the rear, locking the tank in place. With a final movement through the cam, the harness is secured to velcro, thereby locking it in place.

From a practical standpoint, the Snap-Pack is simple to use and simple to change to another tank. If you have several tanks of the same diameter, you don't have to readjust the band. The diameter is maintained even when removed. Different diameter tanks only require a quick movement of the strap. During this test, increasing pressure was applied to the pack to induce slippage. Prior to any appreciable slipping of the tank under abnormal weight applications, distortion of the band always occurred first. For normal usage, with proper adjustment, a diver need not be concerned about the tank dropping out of this pack.

The quick-release harness on the left shoulder also utilizes a velcro system. Velcro, an amazing material, long ago proved valuable in commercial, industrial, and sport applications. Its ability to adhere is not hampered by dirt, mud, or minor intrusions of kelp, eelgrass, etc.

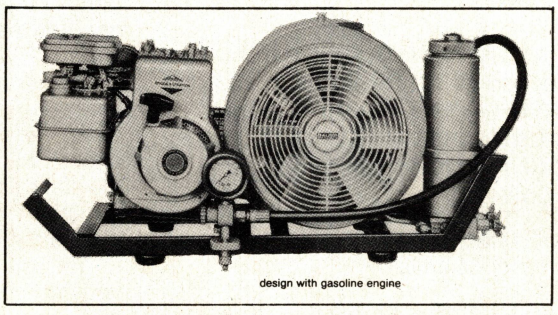
You have heard the old adage of "getting back to the basics." This time, you can do exactly that but still retain the advantages of progress. From Aqua-Craft, the Snap-Pack is available at your local dive shop. The suggested retail price is $39.95 and the unit has an unlimited one year warranty.

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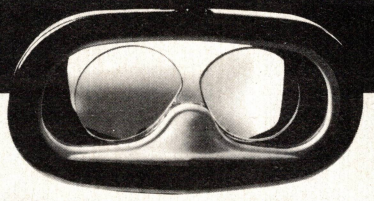
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WIDEN YOUR ANGLE

(Continued from Page 12)

Nikonos 35mm lens to approximately that of a 15mm lens. The specification sheet has subsequently been changed to show a picture angle of 90 degrees.

Baseplates, ball-joint strobe arms and wide-beam strobes for wide-angle U/W photography are also available from Farallon/Oceanic.

CONCLUSION

We compared these lenses over an aperture range of f5.6 to f16 — the f5.6 being the widest aperture most U/W photographers would probably use, and f16 being the smallest aperture of the Sea-Eye 21.

The Nikon 15mm lens produced extremely sharp images from corner to corner with no noticeable distortion. And in addition to being optically superior to the other wide-angle lenses discussed in this article, we believe that it will also outperform most housed 35mm wide-angle systems.

The Sea-Eye 21, Subawider II and Novatek 20 all had good sharpness (resolution) in the central picture area at the higher-numbered stops, but lost sharpness at the lower-numbered stops. The biggest difference was in corner sharpness: As the aperture was opened progressively to the wider stops, the Sea-Eye 21 lost corner sharpness in about the same proportion that it lost center sharpness. The Subawider II lost corner sharpness at a noticeably greater rate, and the Novatek 20 lost corner sharpness at the most extreme rate.

There were also differences in distortion: The Sea-Eye 21 showed virtually no barrel distortion; the Subawider II showed slight barrel distortion; the Novatek 20 showed the most barrel distortion.

Which lens should you buy? It depends on how much quality you require, and how much money you are willing to spend. If you place most of your subjects in the central picture area, having perfectly straight lines at the edges and sharp details in the corners isn't always necessary. Think of how many wide-angle shots show only the openwater background in the corners. Remember that the main purpose of a wide-angle lens is to get you closer to your subjects than you can get with a normal lens, and the increased overall picture sharpness that you get with reduced camera-to-subject distance is much more important than corner detail alone.

But for professional work, publications or extreme enlargement, edge and corner details are more important. At this point, it's largely a question of your willingness to spend money.

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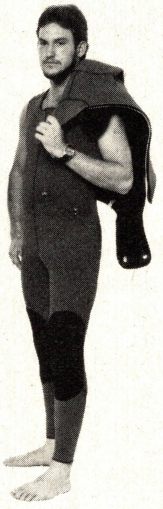
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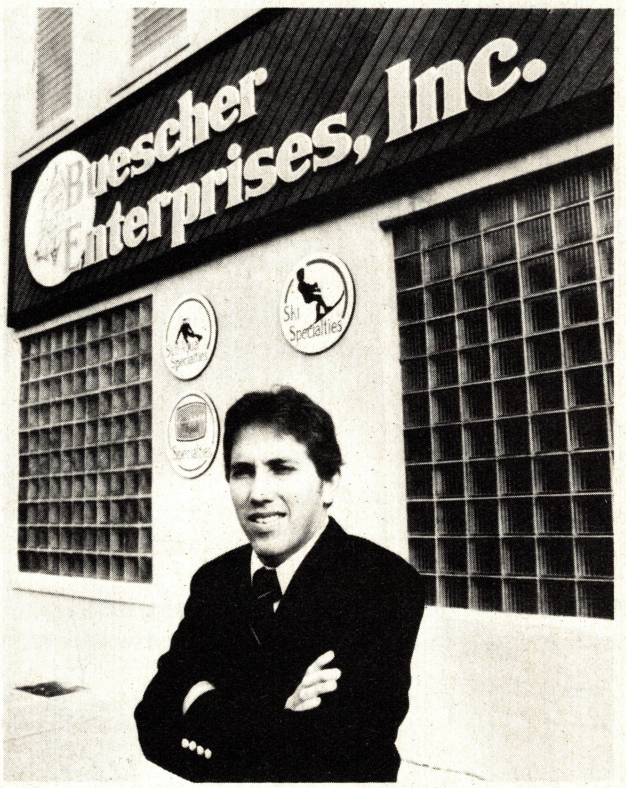


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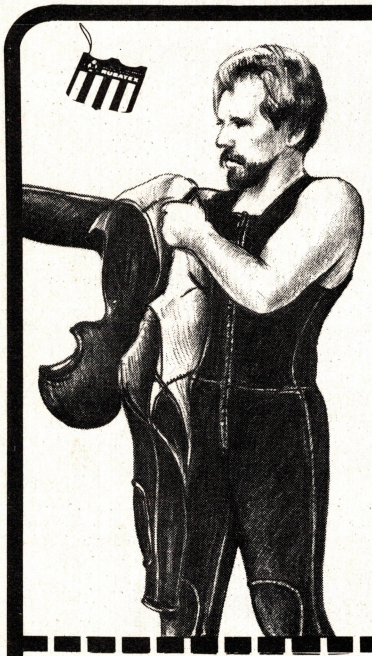
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RAYS OF SOCORRO

(Continued from Page 25)

with us with which we hoped to attract a few sharks to within camera range. We had seen sharks in the area before but they always kept their distance, having no interest in divers as meals and little incentive to pose for portraits. Taking bait down is probably not the wisest way to coexist with potential man eaters, and as we began our descent to the shelf, I suddenly thought we might have pushed the limits of safety right over the brink. During the descent Marty and I saw four large hammerheads and a half dozen large silver tip sharks. This certainly promised to be an exciting dive.

I dashed to the bottom dragging the fish along with me. When I reached the shelf, I dropped the fish into a shallow hole and threw a rock on top of it. As I backed away, I noticed a cloud of fish blood drifting over the drop-off. Two large hammerheads shot up out of the deep water and rocketed away to our left and above us. Marty shot a quick photo of one, but I felt I knew better. Soon I was afraid we would have far more opportunity to photograph sharks than we had bargained for.



But the sharks never came back. I looked over the edge of the drop-off where I had seen ten sharks on the way down, and there were none to be seen. This was certainly the reverse of what I had expected. However, I did see something coming my way. It was a really large stingray nearly five feet across. It soon became obvious that the stingray smelled the fish I had hidden under the rock and was determined to have it. He



swam right up to the hole where the fish was buried and began trying to dig it out. He would have swum right over me had I not moved out of his way. After a short time, two other rays showed up, trailing their eight inch long stingers, and the three of them began circling the fish and taking turns trying to dig it out of the hole. Marty and I shot photographs.

The stingrays wanted the fish so badly that it became obvious they would be eager to take it right from our hands. Although I didn't much like the thought of having an eight inch barb buried in my chest by a disgruntled stingray, I decided to give some hand feeding a try. Soon both Marty and I had the rays eating out of our hands and flapping their huge wings in an effort to pull the fish free from our grasp. It was like having a giant bird perched on an arm.

We played with and photographed those rays during our next two dives. It was certainly an unusual experience to have handled these large and exciting animals. Although the stingray action was probably the highlight of our dive at the Islets of north Socorro, it was not the only thing we experienced. Marty and I would often take breaks from our activity with the stingrays to photograph one of the many mantas that swam by, the large schools of jacks, the yellowfin tuna, and the occasional dolphin.

Ted Waltham ran this first trip to Socorro as an experiment and obviously, the experiment was a success. In the future, Ted plans to take time off from the *Baja Explorador's* schedule of Sea of Cortez trips and spend the month of November at the Revillagigedos Archipelago — next year he is even hoping to reach Clarion. I don't want to miss that one. If you are interested in the *Explorador* November schedule, write to either: Ted Waltham, P.O. Box 120, La Paz, B.C. Mexico or Baja Expeditions, 1628 Monroe, San Diego, California 92116.

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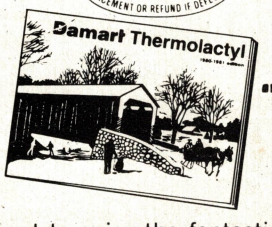
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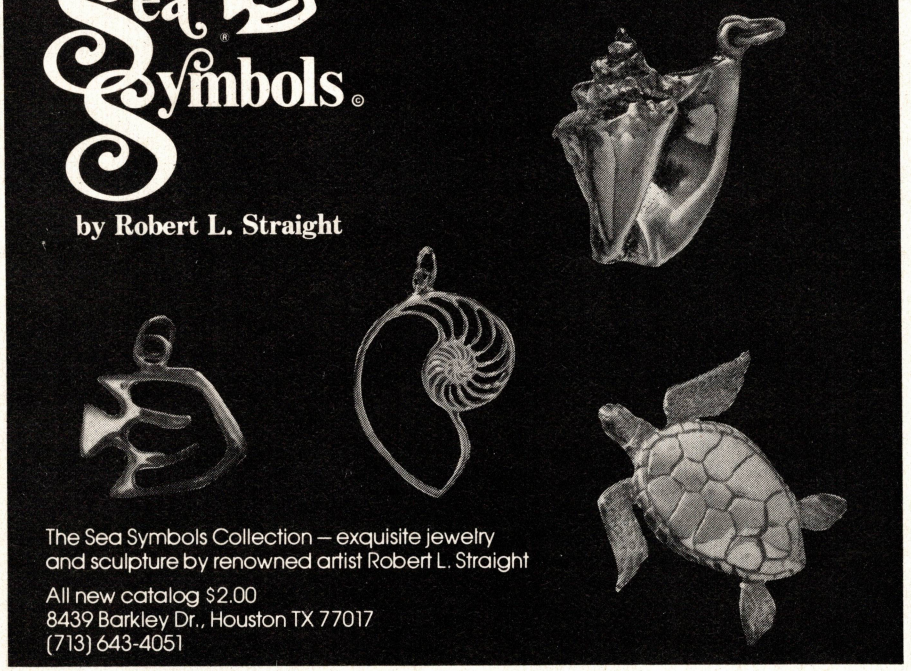
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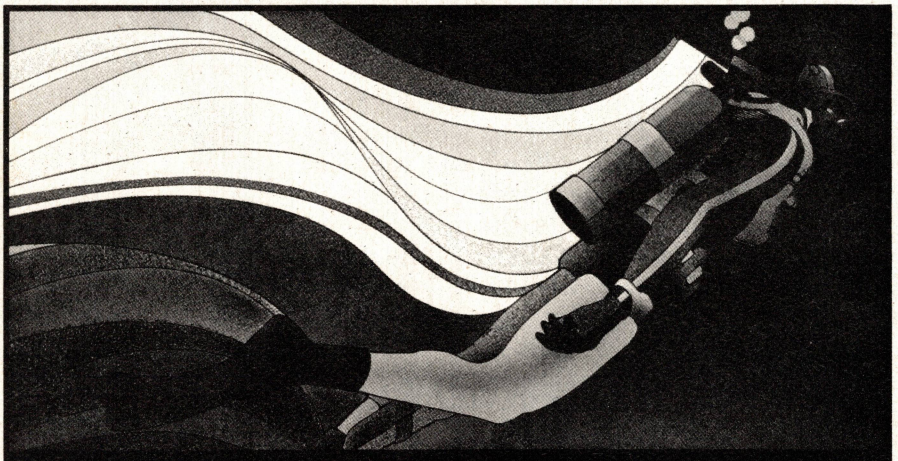
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TECHNIFACTS

(Continued from Page 14)

aromatic service. Even then, hoses in such service require more frequent inspection and maintenance than hoses in other systems.

It is nearly impossible for a diver to positively detect internal hose damage until the hose leaks. However, frequent diver inspections lead to early detection of small leaks so prompt remedial action can be taken.

External hose damage is usually obvious to an experienced diver-inspector. External damage, and eventually complete failure of the hose, may result from kinking; cuts; extensive abrasion due to chaffing; hose failure owing to manufacturer defects; and from gross mechanical damage owing to faulty tanker or terminal operation.

In most tanker moorings, and in other installations using marine hoses, the most common problem is kinking. Kinks can be the result of improper positioning of the tanker in the mooring or berth; incorrect handling of the hose string by the service launch; improper handling of multiple hose strings by the mooring master; and, occasionally, shifting of the tanker in the mooring owing to changes in wind and current. How these accidents occur and the part the diver-inspector can play in preventing hose accidents will be covered in the next Technifacts

A kinked hose, regardless of cause, is easily detected by the diver. When a kink is present, pumping through the hose should not be attempted: This causes more ruptured hoses than any other single cause. When a diver spots a hose that is sharply bent, but not yet completely kinked, pumping should be stopped or postponed because such a hose may quickly develop a full, hose rupturing kink as a result of either tanker movement or with a change in draft of the vessel as the cargo is discharged.

Previously kinked hoses are usually apparent and must be inspected more carefully and more frequently than other hoses.

One of the hazards of continuing to use a hose that has been severely kinked is that each time it is moved a sharp bending action occurs at the site of the old kink. This can lead to early failure of the hose.

Cuts in hoses usually occur as a result of one heavy hose being dragged across another, in a manner such that the flange bolts of one gouge into and cut the carcass of the other. Sometimes a flap is actually cut into or completely out of the hose. Normally this is not cause for taking the hose out of service, but it is a source of continuing potential problems as the cut will slowly become deeper from abrasion and from additional cuts in the same place. When a large flap cut reaches the strengthening wire within the hose it

should be taken out of service until it can be repaired. A hose with a cut also tends to deteriorate more rapidly because the water getting into the fabric making up the plies causes more rapid rotting.

Abrasion of a hose takes several forms. When the hose string is connected to the tanker's discharge manifold, all of the ship's motion is transmitted to the hose string. Because of this, the dip section of the hose string, i.e, that part in contact with the bottom, is constantly in motion and causes abrasion. If the hose lay down area is rocky or of other hard material, there will be excessive abrasion. Since the same hoses will always be in the dip section in any particular mooring those hoses in the dip will wear faster than others.

On some vessels the bilge keel will occasionally project far enough past the side of the ship so that the hose string, when moving back and forth with the vessel's movements, can rub along the bilge keel. Almost never is a bilge keel smooth, it usually has welds, nicks, etc., along the edge. These can cause rapid abrasion and ultimate failure of the hose at the point of contact.

As with any other manufactured article, defects can be present in a marine hose. Occasionally a diver comes in contact with what is termed a nipple leak. Inside the hose the seal between the liner and the steel nipple is broken, or may never have existed to a complete degree. When this seal is broken, the product being pumped can slowly work its way along the nipple until it reaches the end of the multiple layers of material making up the hose. A large bubble of product then grows around the nipple next to the flange but under the covering layer of rubber. A diver-inspector must be particularly alert to any dissimilarities in the hose nipples so he can detect a problem early. A hose with a nipple leak must be removed from service not only because it leaks oil but also because it is not possible to tell externally how serious the internal problem may be.

Flat hoses occur (usually) when a hot cargo is discharged and the system then allowed to cool. The shrinking product in a rigid pipeline system, but open to a flexible hose string, causes the partial vacuum thus created, plus the weight of water over the hoses, to completely flatten the hoses. If the hose that has been flattened is one with solid wire strength members there is danger that the wires will be broken at the creases. If the strength wires are braided and flexible no great harm will be done unless the hoses are continually flattened, stretched, flattened again, etc. Then the carcass of the hose itself would be subject to ultimate failure.

Excess stress on hoses causes them to become ridged. Hoses such as this could be x-rayed under water but it is better, and not much more expensive, to replace the damaged hose.

Ruptured hoses are obvious because of the spilled product. The work of the

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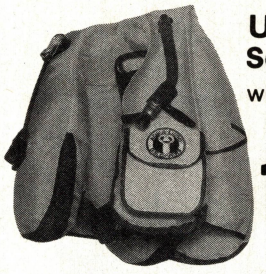
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TECHNIFACTS

diver-inspector in such cases is to determine the extent of the damage and to install blind flanges to stop the flow of product until a new hose, or hoses, can be installed. Methods of diver hose change-out will be covered in future Technifacts.

Marine hoses are connected to the main submarine pipeline via a short pipe spool, usually coming off the side of the sub line. Occasionally, a hose string is pulled hard enough, or in the wrong direction, so that this pipe spool is kinked. Invariably a piece of pipe kinked in this manner will wrinkle in the inside area of the kink and the pipe then splits open and leaks. Such a leak is not large and the hose can be laid down in water, disconnected, and a new spool installed.

Air sometimes gets in the hose string, probably during the stripping action when the last of the cargo is being picked up and discharged by the stripping pumps. This air is locked in the hose when the end valve is closed. If only one section of hose is left filled with air and put in the water, only the end section will float slightly off the bottom. However, if three or four sections of hose are filled with air the hose will float nearly to the surface. This floating action usually occurs slowly. Floating hoses can be hazardous if the next vessel using the mooring enters before the hose problem is detected and remedied.

Hose inspections can be a steady source of work for a knowledgeable diver-inspector. Inspect with care and thoroughness. Report things as they are. Standardize inspection procedures and reporting forms. Carry underwater slates and pencils and make extensive notes of findings. Try to get the serial numbers of the hoses for which you make reports. Almost all hoses have serial numbers welded to both flanges of the hose. In most terminals, hoses are numbered consecutively with the number one position next to the pipe line, hose in position number 2 next, etc., to the seaward end.

Methods of x-raying hoses underwater and cathodic protection survey and inspections will be dealt with in later Technifacts. All these skills provide work for a trained commercial diver. They are skills easily learned by a sport diver willing to study.

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Recent evidence that scuba diving during pregnancy may be harmful to a fetus has alarmed divers and physicians throughout the country. According to a Texas study, the fetus is more susceptible than the mother to decompression sickness, or the bends.

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minute dive, near-term sheep fetuses showed severe bubble formation. In none of these dives did the mothers demonstrate any signs of decompression sickness.

With support from the University of Wisconsin Sea Grant Program, physiologists Michael K. Stock and John H G. Rankin repeated the experiments in the high pressure chamber in the UW-Madison Biotron. They surgically instrumented sheep fetuses so that blood flow could be monitored, but unlike the Texas researchers, Stock and Rankin also included uninstrumented fetuses in their study.

The Wisconsin researchers found that all of the surgically prepared fetuses developed severe bubbling following simulated dives, while the undisturbed fetuses showed no signs of bubble formation.

"We even had sets of twins in which one fetus was instrumented and the other untouched," says Stock. "The monitored fetuses died, while the untouched fetuses appeared normal following the dive."

Stock and Rankin tend to be conservative about drawing conclusions, however, and suggest caution be used in safety recommendations to women divers. "We don't have the evidence yet to say that diving during pregnancy is safe," says Stock. Stock and Rankin plan to continue research on the safety of diving during pregnancy and are making progress towards developing experimental procedures that do not induce decompression sickness.

Diver's Calendar

October 5 Diver's Flea Market, Southampton College, Southampton, Long Island, NY (Contact: Adam Cohen, Box 463S, Southampton College, Southampton, NY 11968)

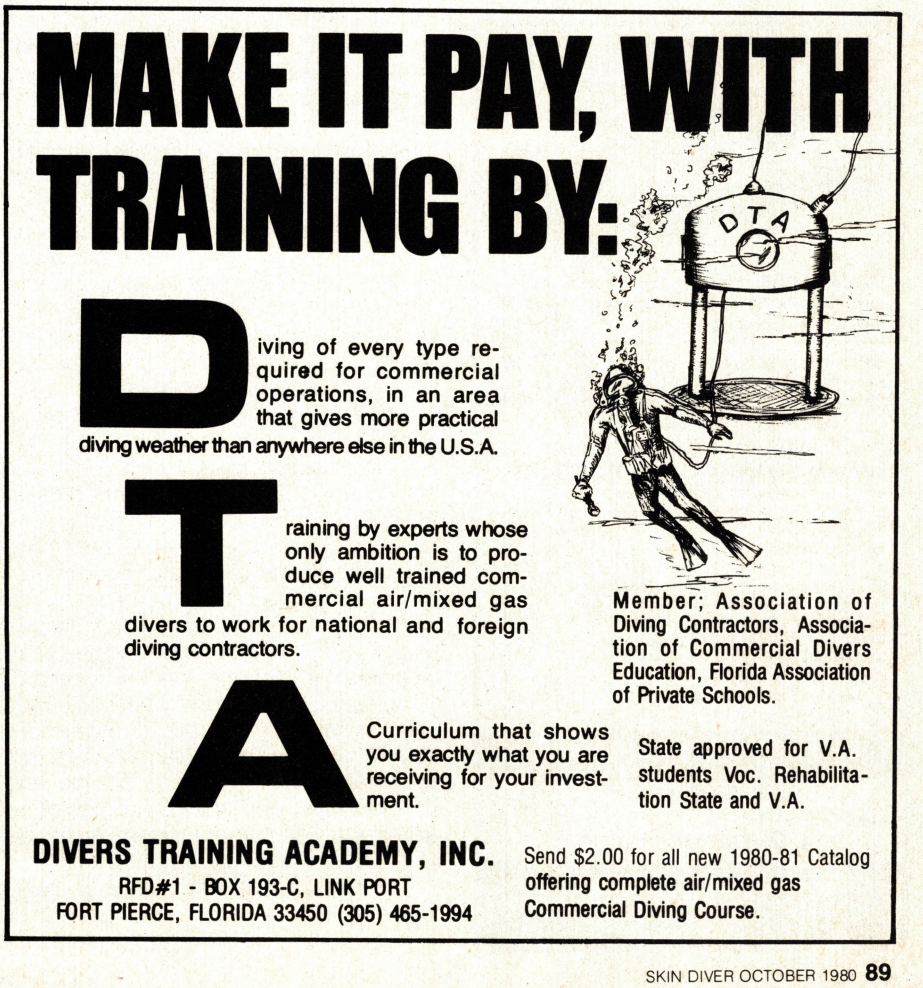
October 24-25 Dive to Adventure with Jack McKenney, Rockford Divers Association, South Beloit/Holiday Inn, 8 p.m. (Contact: Bill Steinborn, 1385 Randall Dr., Rockford, IL 61108)

October 25-26 Southern California Conference on U/W Education, Orange Coast College, Costa Mesa, CA (Contact: Soc-Q, Susan Bangasser, 12724 Valley View Lane, Redlands, CA 92373)

October 29-30 British SubAqua and British Society of U/W Photographer's Film Festival, British Commonwealth Institute, London, England (Contact: BSOUP Film Festival, 6 Gwynne Rd., London SW11)

November 1 Seamark '80, New England Aquarium, Boston, MA (Contact: Seamark, Cotting School for Handicapped Children, 241 St. Botolph St., Boston, MA 02115)

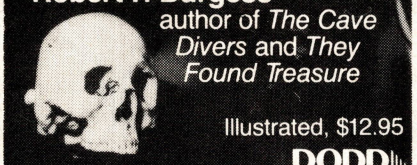




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BELLS, BOLTS, BRAINS

(Continued from Page 31)

the KM 17 and Swindell and Aquadyne hats. They also learn mixed gas diving and chamber operations — including surface decompression, treatment procedures, and oxygen tolerance tests. Dives in the Santa Barbara harbor in both light and heavy gear, working on projects such as rigging and hull inspections, are made during the first year.

The third semester is devoted to underwater burning and welding; the use of hand tools; rigging and lifting; and concreting and patching materials, Students also start using hot water suits — a standard piece of equipment in many areas, including the North Sea — and familiarize themselves with the bell/saturation system and control van, studying the layout and various sub-systems. Offshore dives for the semester consist of burning projects in depths to 60 feet, using light or heavy gear, and wellhead inspections in light gear in 70 feet of water.

Dive instruction during the fourth and final semester concentrates on bell/saturation techniques and a class in underwater operations which consists of training in a wide range of tasks commonly performed by oilfield divers. Bell and saturation diving have become increasingly important as oil exploration has moved into deeper and deeper water. Although mixed gas hardhat gear was formerly used as deep as 400 feet or more, bottom time was necessarily short and the risk to the diver generally unacceptable — especially in strong currents and cold water. The diving bell provides a safe, dry refuge from which to work and functions as an elevator between the surface and the job. When used in conjunction with a saturation diving system — as is usually the case — it allows around-the-clock diving; interrupted only by the time it takes to switch diving teams. Using this method, work is routinely carried out in depths down to 600 feet and, occasionally, in as much as 1000 feet. It is fair to say that the deeper oilfields of the last few years would never have been developed without saturation diving. Not surprisingly, a thorough knowledge of all aspects of bell and saturation systems is a prerequisite for employment with most major dive contractors. Furthermore, OSHA regulations now require the use of a bell and mixed gas below 220 feet and, in the British and Norwegian sectors of the North Sea, the equipment is mandatory beyond 50 meters (165 feet).

The bell and deck chamber at Santa Barbara City College were donated by

(Continued on Page 94)

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TREASURE FLEET

(Continued from Page 65)

the cleared area, and we hit it! Working in the foggy darkness we began to get hits with our metal detector. Groping under the head we felt what must be coins. As each hit was uncovered it was slipped under the cuffs of our wetsuits. Only after we were standing on the stern of the salvage boat and had unzipped our wetsuits did we realize that all of the coins were gold! Over 40 were recovered in a relatively small area near the cannon float. Almost as if fate had stepped in, the black warning clouds of hurricane David filled the skies to the south and we begrudgingly pulled our anchors in and made a dash for the Ft. Pierce inlet. The seas were rolling and white water was breaking over our stern, as we rounded the breakwater and headed into our berth at the City Marina. All lines were tripled up, and deck gear made fast. In spite of our efforts, after the hurricane passed the *Bamboo Bay* lay sunk at its mooring. Our dive season was ended, but it couldn't wipe the smiles from our faces. A total of 62 gold coins, over 2500 silver coins, 27 pieces of fine worked gold jewelry, and many other priceless artifacts were recovered. It was a great year by any standard.

The *Bamboo Bay* was refloated and patched, and is ready for action again. We have already made our plans to return to the *Rosario*, and with luck, and our metal detectors, we are looking forward to another bonanza year.

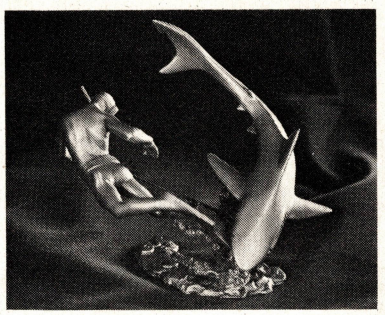
FISH TRAP BAN

The Florida League of Anglers' president, Robert C. Schwebke, hailed the legislature's passage of the League-backed bill prohibiting fish traps in Florida waters as the beginning of a new era of cooperation in the conservation and management of that state's declining marine resources.

Led by the FLA, recreational, charter, headboat, and commercial hook and line fishermen, as well as sport divers, have for the first time united behind a single conservation measure.

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PADI recently introduced new metric dive tables to its ever expanding line of diver educational materials. The popular format and design of the PADI Dive Tables has not changed, nor has the four by eight and one-half inch size. However, the depth columns on the tables now read in both feet and meters; extremely useful for those divers using metric gauges. The PADI dive tables will continue to be printed on durable plas-



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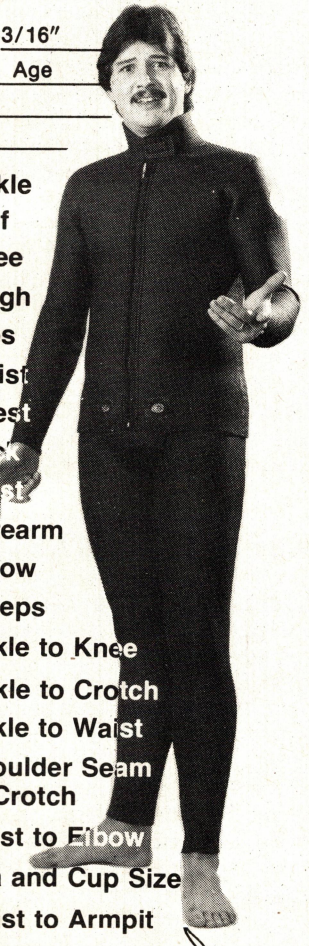
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SUMMER/FALL WITH STAN WATERMAN

During early June, Stan Waterman and his daughter, Susy, spent two weeks in the Red Sea filming along the eastern Sinai coast, from Eilat to Sharm el Sheik.



The new film, produced under the aegis of El Al Airlines and La Mer Diving Safari, will premiere at the next DEMA show, January 17-20, Las Vegas, Nevada.

In July, Stan and his eldest son, Gordy, did the underwater shooting for an ABC American Sportsman production at St. Croix, Virgin Islands. Assisted by Brian Friedman, St. Croix divemaster, they worked with former astronaut, Scott Carpenter, and the staff of the West Indies Lab, documenting Carpenter's visit to the undersea habitat there.

The father and son combination worked together again in the Sea of Cortez in August, this time teaming up with veteran shark filmer, Howard Hall. Their cameras focused on the mass schooling of the hammerhead sharks for another American Sportsman show. Peter Benchley, author of *Jaws*, joined the production.

On October 29, Stan will host an underwater film festival in London, sponsored by The British SubAqua Club. A representative selection of some of the finest work by American underwater cinematographers will be presented on two consecutive evenings, October 29 and 30. Filmmakers represented are Al Giddings, Jack McKenney, Robin Lehman and Stan Waterman. Ron and Val Taylor's work will also be included.

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BELLS, BOLTS, BRAINS

(Continued from Page 90)

Ocean Systems Inc., and completely reconditioned by students. The control van was built at the college and is of a superior layout to many found offshore. During a typical class session, students are assigned job functions by a supervisor appointed for the day. In this way, students learn the duties of every member of a bell crew — from tender to saturation technician — and the importance of teamwork. The divers, after locking-out from the bell, work on a typical oilfield project — such as installing a spool-piece — that requires the use of various power tools and coordination with the topside crew. Before leaving the tank, the bell is blown-down to simulate a greater working depth and a complete transfer and decompression cycle is carried out once the bell is mated to the DDC.

Saturation dives of at least 24 hours are made several times during the semester, with two teams of divers living under pressure and working alternate shifts on the bottom. The deck crew works 12 hour shifts — as they would offshore — monitoring conditions in the chamber and supporting the work underway.

To supplement the instruction they receive at the college, the Marine Technicians spend two days working with a bell system located on a barge offshore. Lock-out dives are made in about 40 feet of water over a soft mud bottom, making for realistic working conditions.

During the final months of the program, the second year students make a 100 foot inspection dive on an oil platform in the Santa Barbara Channel, using hot water suits and band masks, or the KM 17 helmet. A written report is required from each student and any significant observations are passed on to the oil company.

Santa Barbara City College accepts 52 students into the program each fall. With the returning students, the total enrollment is approximately 90 at the start of the year. To be admitted to the program, you must be 18 years of age and a graduate of an accredited high school with a "C" average, or better, and have completed high school chemistry and math through algebra with a minimum grade of C. You must also make satisfactory scores on either the SCAT, ACT, or SAT test and pass a physical examination and swimming test. The physicals are given by a medical diving specialist and include an X-ray to check for back abnormalities, which have been the cause of refusal of employment in the U.S. recently — although this has not been a problem for those going overseas. A physical is also required for the second year, but the back X-ray is not repeated.

It cannot be emphasized enough that a strong mechanical aptitude is a prime prerequisite for anyone entering the Marine Technician Program. Commercial diving is a technical occupation involving the constant use of tools and bears little or no relation to the type of diving done by scientific institutions. Much of the work consists of heavy construction jobs — frequently under less than ideal conditions.

A potential oilfield diver should realize that life in the offshore industry is anything but glamorous. The hours are long, the work hard, and many months of the year must be spent away from home in often uncomfortable conditions. It is certainly not a career for the home-loving family man. On the other hand, the financial rewards can be excellent: Earnings of $50,000 a year, or more, among City College graduates are not uncommon and, for those with the necessary aptitude, there are real opportunities for eventual movement into management.

Finally, this article would not be complete without a word about the late Ramsey Parks, Department Chairman until his death in January of 1980. Ramsey coordinated the program from the start and was largely responsible for its success; indeed, it is no exaggeration to say that without his immense ability and dedication, the program would never have become what it is today. There can be no more fitting tribute to his memory than the worldwide reputation it enjoys.

MONITOR ARTIFACTS

For the first time since their recovery last summer from the sunken Civil War ironclad *U.S.S. Monitor*, a number of artifacts have been put on display in Washington, DC. The artifacts are available for public viewing for at least one year at the Navy Memorial Museum at the Washington Navy Yard.

Submersibles and divers from Harbor Branch Foundation, Inc., Fort Pierce, Florida, were used to retrieve the artifacts from the wreck site off the coast of Cape Hatteras, North Carolina.

INSTRUCTOR TRAINING

Sport Tours and PADI master instructor Larry Ogburn announced a special PADI instructor training course to be held in San Andres, Colombia, October 4-18, 1980. The cost of the two week training course will be $1350 and will include: Round-trip air fare (Miami/San Andres), room (double occupancy), two meals per day, ground transfers, diving, and a complete PADI instructor training course. The course will be held at the Bahia Marina Diving Resort on the beautiful island of San Andres. Contact Sport Tours at (305) 595-1813.

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STAN WATERMAN RECEIVES SERVICE AWARD

The New Jersey Council of Diving Clubs annually presents a service appreciation award to the skin and scuba diving communities in the state of New Jersey. The fifth annual award was presented to Stan Waterman at an evening film festival last November.

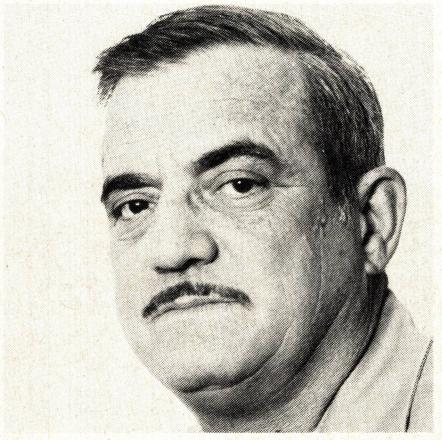

Stan Waterman accepts New Jersey Council service appreciation award from Lee Ward.

The *Stan Waterman Show*, hosted by a Princeton scuba club and co-sponsored by the New Jersey Council of Diving Clubs, featured outstanding films about whales, sharks, and treasure presented by their creator, Waterman.

Stan Waterman is special to New Jersey divers not only because he resides there, but because he promotes an image with his films and lectures that divers are proud of around the world. Stan was presented with a deadeye recovered by New Jersey divers from the wreck of the *Iberia* near the mouth of the New York harbor.

SCHNEPF'S 110TH DIT CLASS

With the graduation of the September class, Robert Schnepf, Master Diver/ Senior Instructor at the Divers Institute of



Technology, celebrated his 110th class anniversary with the Seattle-based professional deep sea diving school. Schnepf joined DIT as an instructor after serving 30 years in the U.S. Navy, retiring as a Master Diver.

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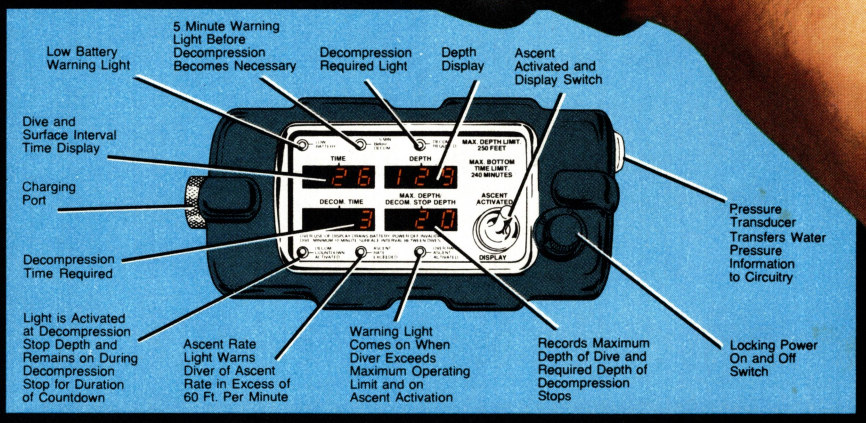
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